THE ARCHITECTURAL FORUM

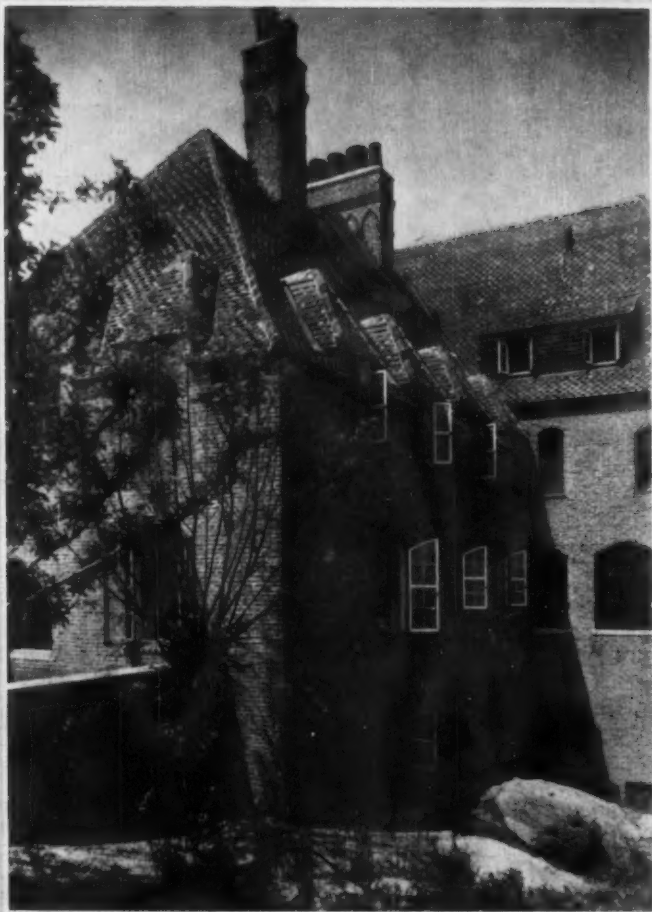
IN TWO PARTS

PART ONE

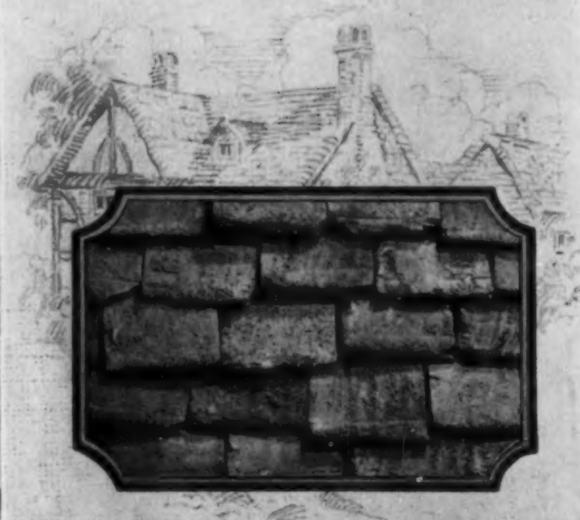
ARCHITECTURAL DESIGN

OCTOBER

1928



The fine country residence of Harry J. Guggenheim, at Pt. Washington, Long Island. Fredrick Sterner, Architect.



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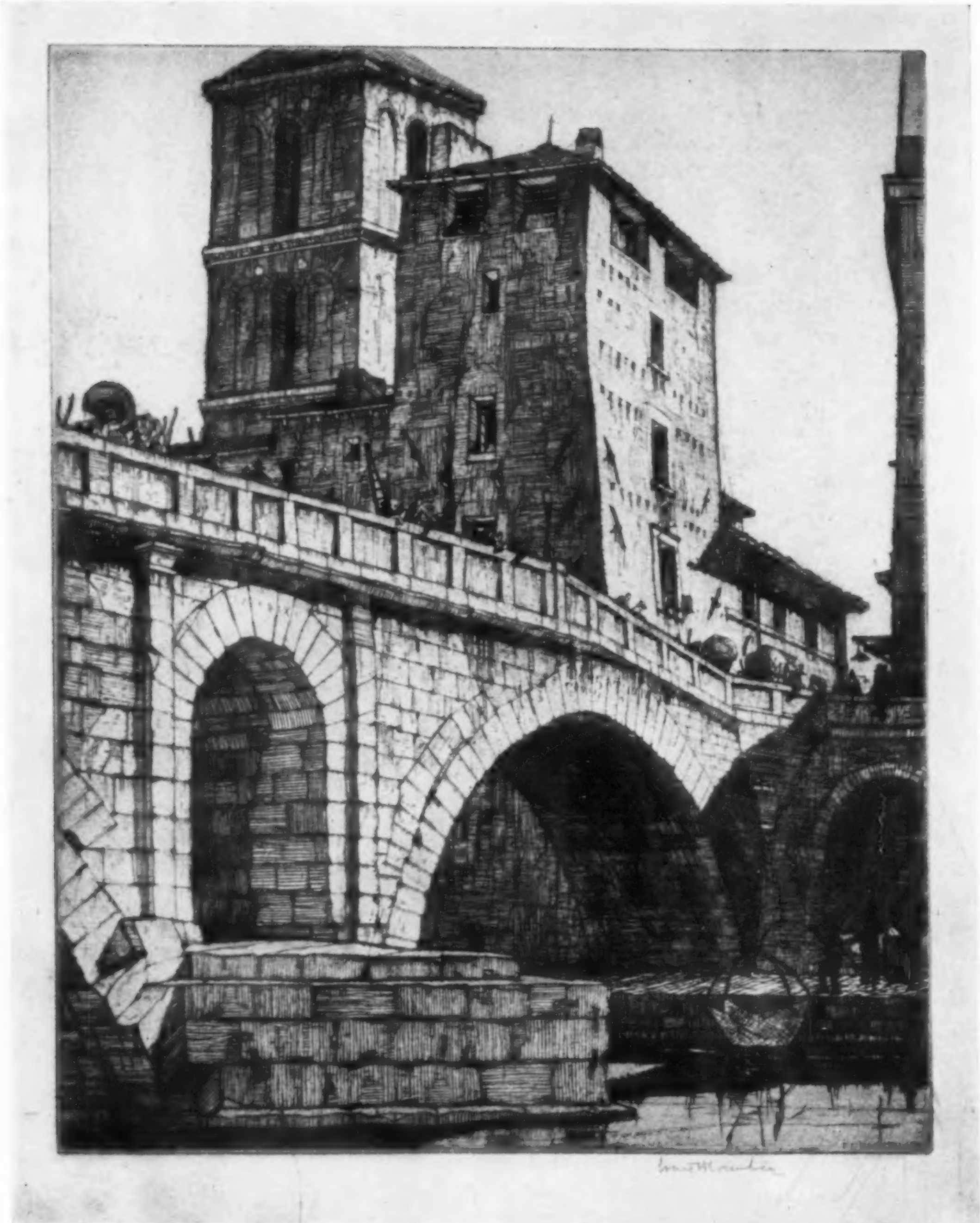


PONTE FABRICIO, ROME

From an Etching by Louis C. Rosenberg

THE
ARCHITECTURAL
FORUM

VOLUME XLIX NUMBER FOUR

OCTOBER 1928

THE NEW BUILDING OF THE GERMANIC MUSEUM, HARVARD UNIVERSITY

BY
KUNO FRANCKE

IN speaking of the Germanic Museum building as "new," it should be said that it was completed during the World War and opened to the public in 1921. At that time, however, the state of public feeling aroused by the war was still such that this essentially German building failed to attract the attention which it otherwise, by reason of its originality and artistic merit, would have received.

Its designer is Professor G. Bestelmeyer, one of the foremost living German architects, now President of the Munich Academy of Fine Arts. His general drawings arrived in Cambridge in various installments before and after the outbreak of the war. His personal supervision of the construction being out of the question, the firm of Warren & Smith, of Boston, appointed by the Harvard Corporation as associate architects, undertook this task, the senior partner, Professor H. Langford Warren, then Dean of the Harvard School of Architecture, devoting himself chiefly to the supervision and, wherever necessary, the modification of the architectural features, while F. Patterson Smith, the junior partner, attended to all matters connected with the engineering part of the work. Both men rendered invaluable service in this cause. In fact, it is they who translated the ideas of the German architect into American terms and thus produced a structure in which different conceptions of artistic problems have been blended with remarkable success.

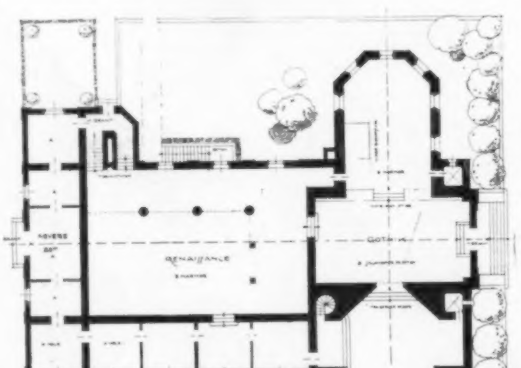
To Professor Warren belongs the credit of choosing the decorative finish of most of the architectural detail. He selected the Indiana limestone for the structural supports of outer and inner walls, the patterns of the tile floors in the transept and chapel, and the plain quarry tiles in the Renaissance wing. He devised with the greatest care the whole color scheme of the interior. He supervised all the fine decorative ironwork, made after Professor Bestelmeyer's designs by Frank Koralewsky, of Boston. Professor Warren engaged Roger Noble Burnham as sculptor of the centaur figure on the stone dormer of the west side of the Renaissance wing and the Minerva head over the Divinity Avenue entrance. He directed the remarkable modeling by Mr. Kirchmayer of the heads of Wotan, Siegfried and Brunhild on the south facade of the Renaissance wing, and of the Apollo head over the front entrance, and brought all the other carved decorations over doors, windows, and balustrades into harmony. He made necessary changes in the levels of various floors and in the shape of the arches of the cloister. That death should have removed him from the midst of his devoted work gives to the connection of his name with the Germanic Museum a tender association.

Mr. Smith selected the red tiles of the roof, the Vermont porphyry for the columns of the Renaissance Hall, the slabs of split slate for the floor of the Romanesque Hall, and the solid and unsmoothed oak timbers framed in antique manner for the cloister of the court, and he worked out the whole scheme of designing, placing and finishing the reinforced concrete frame of the building,—a task attended with considerable difficulty because of the great structural variety of Professor Bestelmeyer's design. Indeed, it may without any exaggeration be said that many features of this construction had never been attempted in this country, and therefore they constitute a real contribution to American engineering. Particular mention should be made of the use of the precast segments of the dome over the Baroque vestibule as forms for the concrete ribs, and of the tooling of the surfaces of the concrete arches and vaults in both the Romanesque Hall and the Gothic Chapel, thereby exposing the coarse aggregate of the concrete. Credit for one part of the building belongs entirely to Mr. Smith. Professor Bestelmeyer's plans had left the upper story unfinished. Here Mr. Smith, having after Professor Warren's death established a firm of his own, constructed over the Renaissance Hall a very attractive lecture room of monastic appearance, and connected it by stairways with both the street level and the gallery of the second story. The completed building, as it now stands, is a fine example of the modern Munich school of architecture of which Bestelmeyer is the most illustrious living representative. He began some 25 years ago as a pupil of Gabriel and Emanuel Seidl, the architects of the great *Bayrisches National Museum*, with whom he shares a love of the picturesqueness of Bavarian popular art. His first

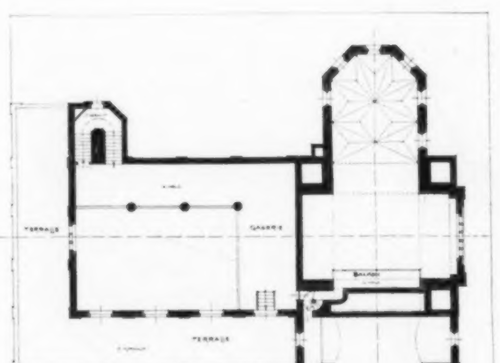
work, of unquestionable genius, was the enlargement to more than four times its original size of the main building of Munich University. Leaving untouched the old severely monumental front on the Ludwigstrasse, he erected on the parallel Amalienstrasse a front of equal length, but of much greater richness of detail, and connected the two facades by a system of halls and galleries surrounding a magnificent vaulted court of bold and striking originality.

It was this splendid achievement by a young man, showing both respect for traditional forms and a marked power of developing them into something new, which made it clear to me that here there was a most unusual opportunity of acquiring a type of build-

Germanic Museum, Harvard University
Professor G. Bestelmeyer, Architect
Warren & Smith, Associated Architects



Ground Plan

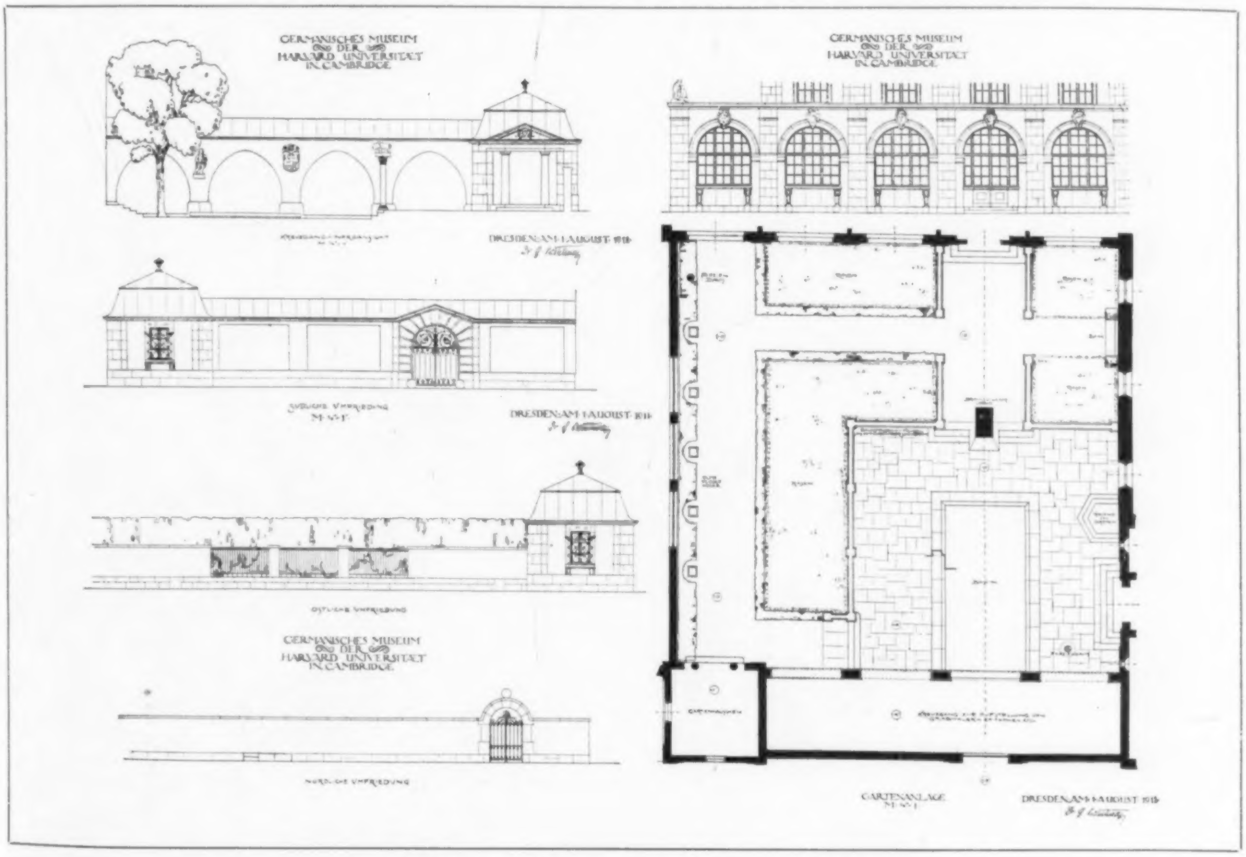


Clerestory Plan

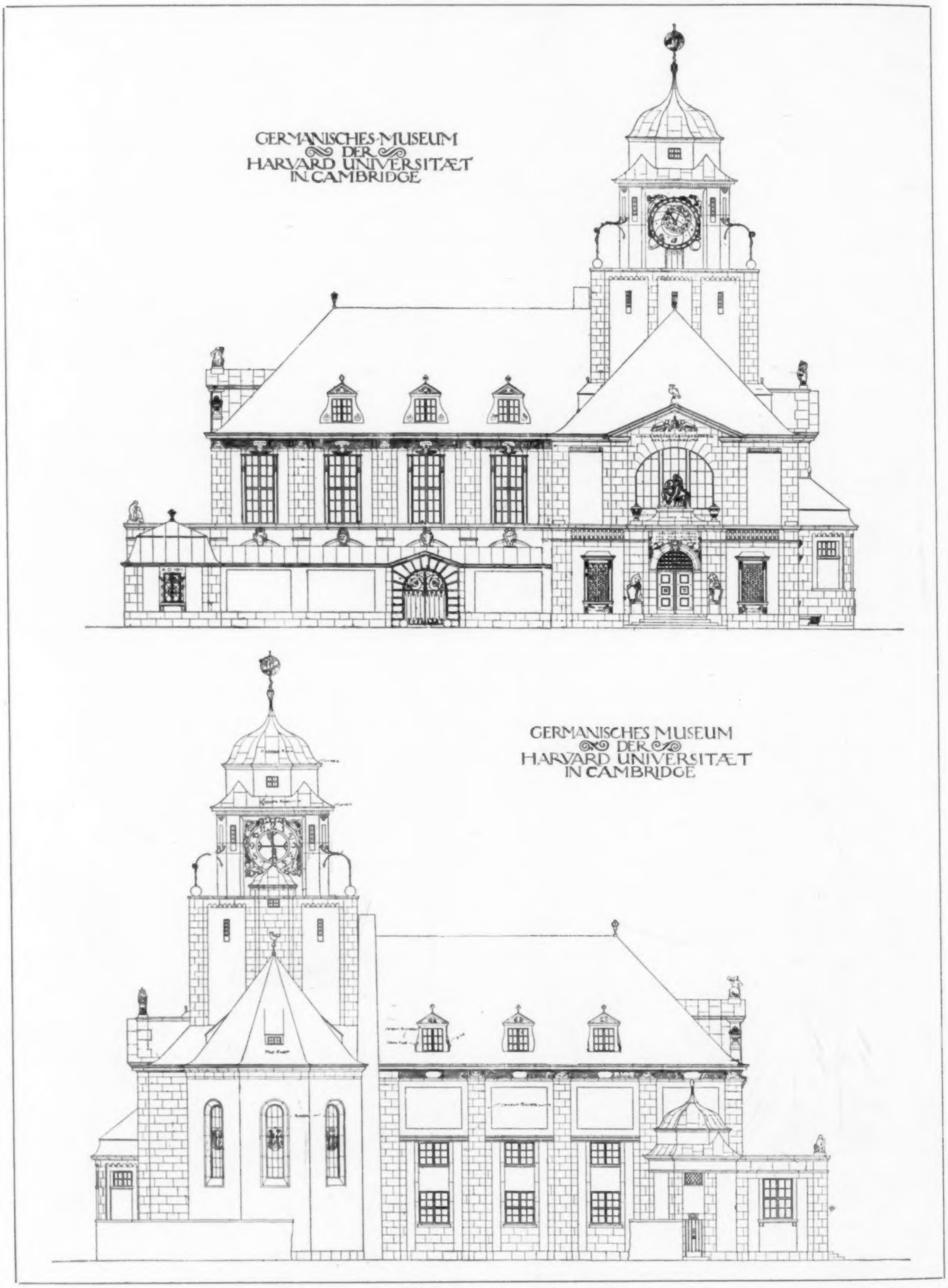
ing for our museum in Cambridge, which, instead of repeating the meaningless formulæ of classicist imitation, should be an original artistic expression of what this particular museum stands for,—the history of German culture. Together with Professor Warren, I arranged, in the summer of 1910, a meeting with Bestelmeyer, then a professor at the Dresden Academy of Art, and it was a delight at this meeting, held at a quiet inn near Goethe's garden house in Weimar, to see with what enthusiasm and deep understanding he entered into the matter. From the very first he saw that the building must be, above all else, an adequate setting for the objects constituting our collection, and that each of these objects,—casts of sculpture and architecture,—should, as far as possible, form an integral part of the structure, that they should be set against a background suggesting the time and the local surroundings of the originals, and that the whole building therefore should be a visible epitome of the various epochs through which German art has passed since the Karolingian era. And this is what the design, within the limitations set to it by available space and money, has indeed achieved.

I cannot refrain from mentioning that before we knew of Bestelmeyer, Professor Warren had himself drawn a tentative plan of a building for us, the elevation of which I published as a frontispiece of the first edition of my Museum Handbook. That after having become acquainted with Bestelmeyer's work he should not only have immediately withdrawn his own sketches, but should have devoted himself wholeheartedly to the most scrupulously exact and careful carrying out of the plan of his German colleague, is but another proof of the nobility of his character.

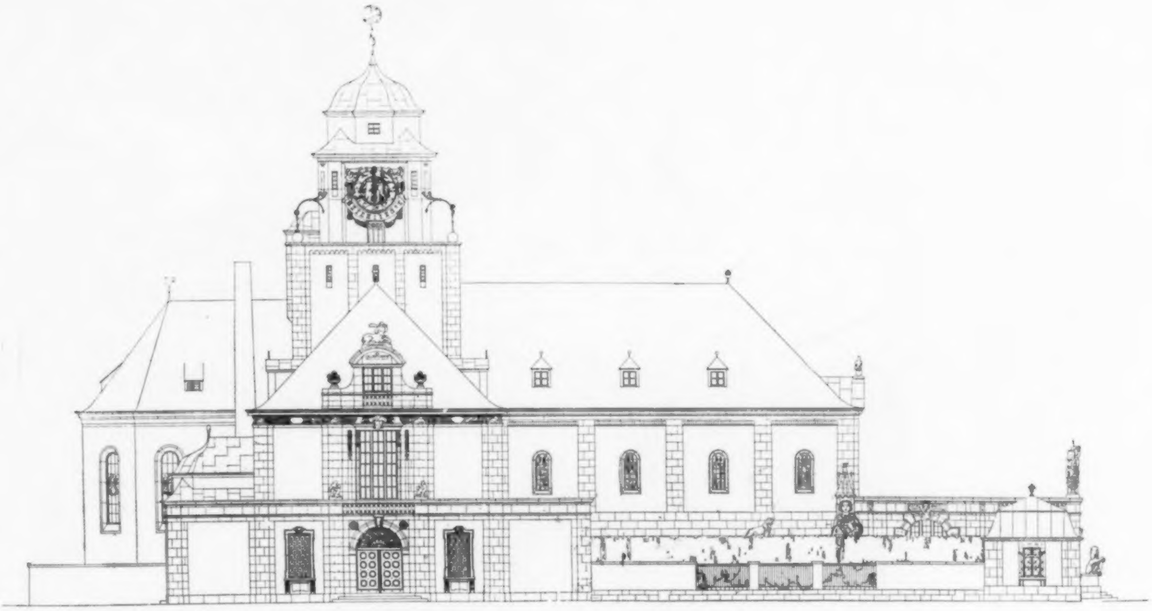
Perhaps the most striking impression on approaching the main entrance on Kirkland Street is that in spite of its small dimensions the building produces a decidedly monumental effect. This is due largely to the fact that in front of the main structure there stands out on the south side a breastwork, so to speak, of lower structures connected with one another, a continuous line running from a little square pavilion to a wall of cloistered arcades and thence to a little square vestibule back of the main entrance. This line of walled enclosures permits only a glimpse, through a wrought iron gate, of the decorative court lying back of it and shuts off the view of the whole lower story of the main building, thereby producing illusions of perspective which make the limestone and stucco walls of the second story and the massive red tile roof resting upon them appear much larger than they really are. This imposing effect is heightened by the complicated floor plan of the main building. It consists of two wings of unequal length, placed at a right angle to each other. The longer wing, containing the Romanesque and Gothic Halls, extends along Divinity Avenue, ending in a chapel-like apse; the shorter wing, containing

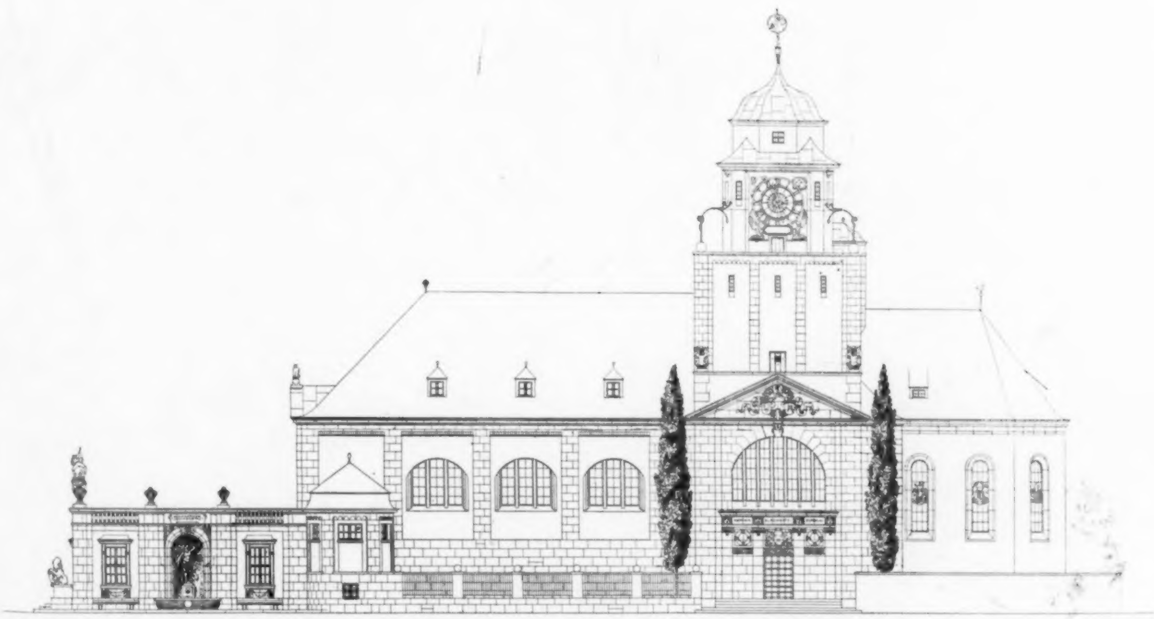


Plan of Garden Cloister, and Elevations on Garden Court

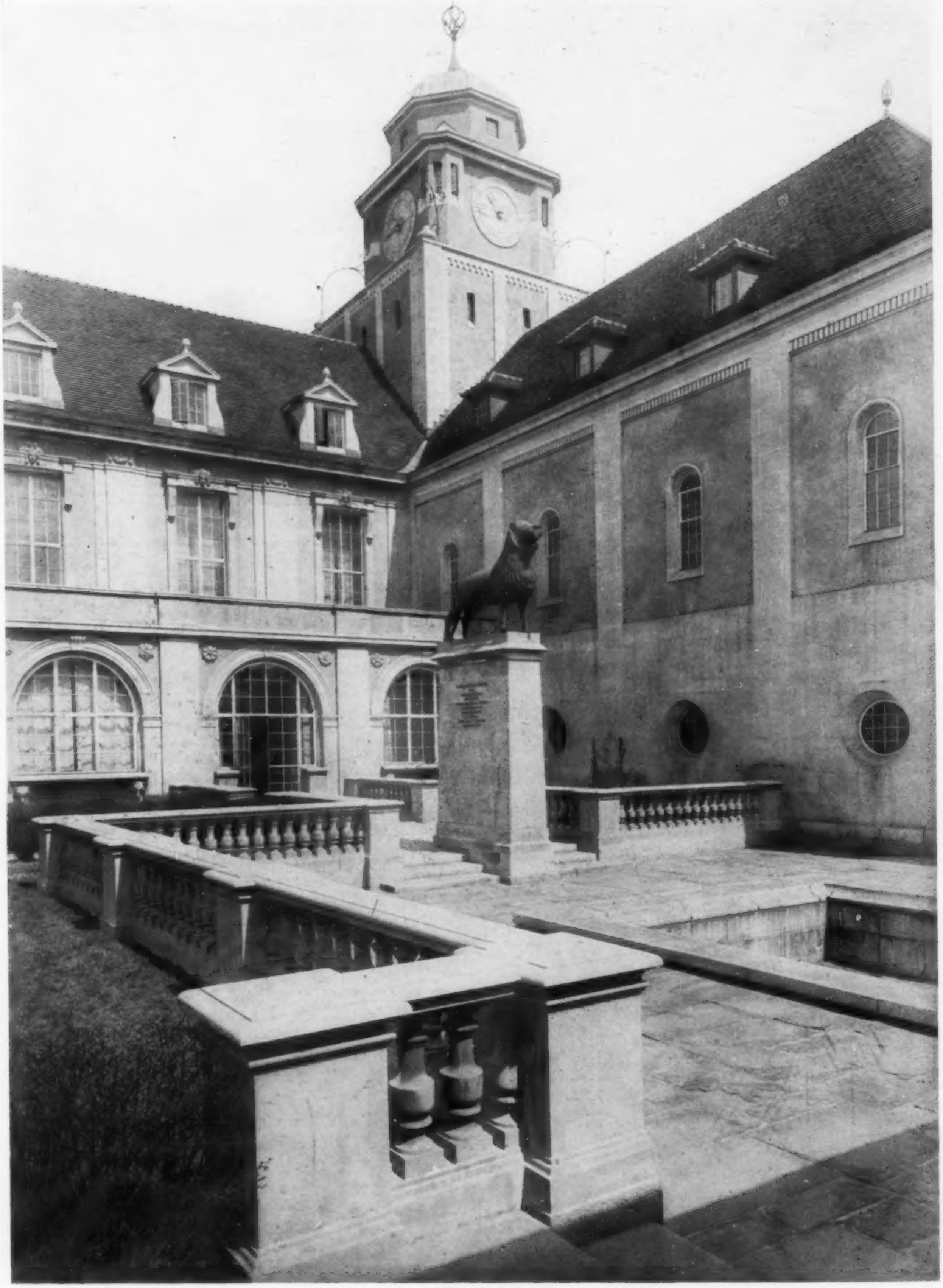


NORTH AND SOUTH ELEVATIONS
GERMANIC MUSEUM, HARVARD UNIVERSITY
PROFESSOR G. BESTELMEYER, ARCHITECT
WARREN & SMITH, ASSOCIATED ARCHITECTS

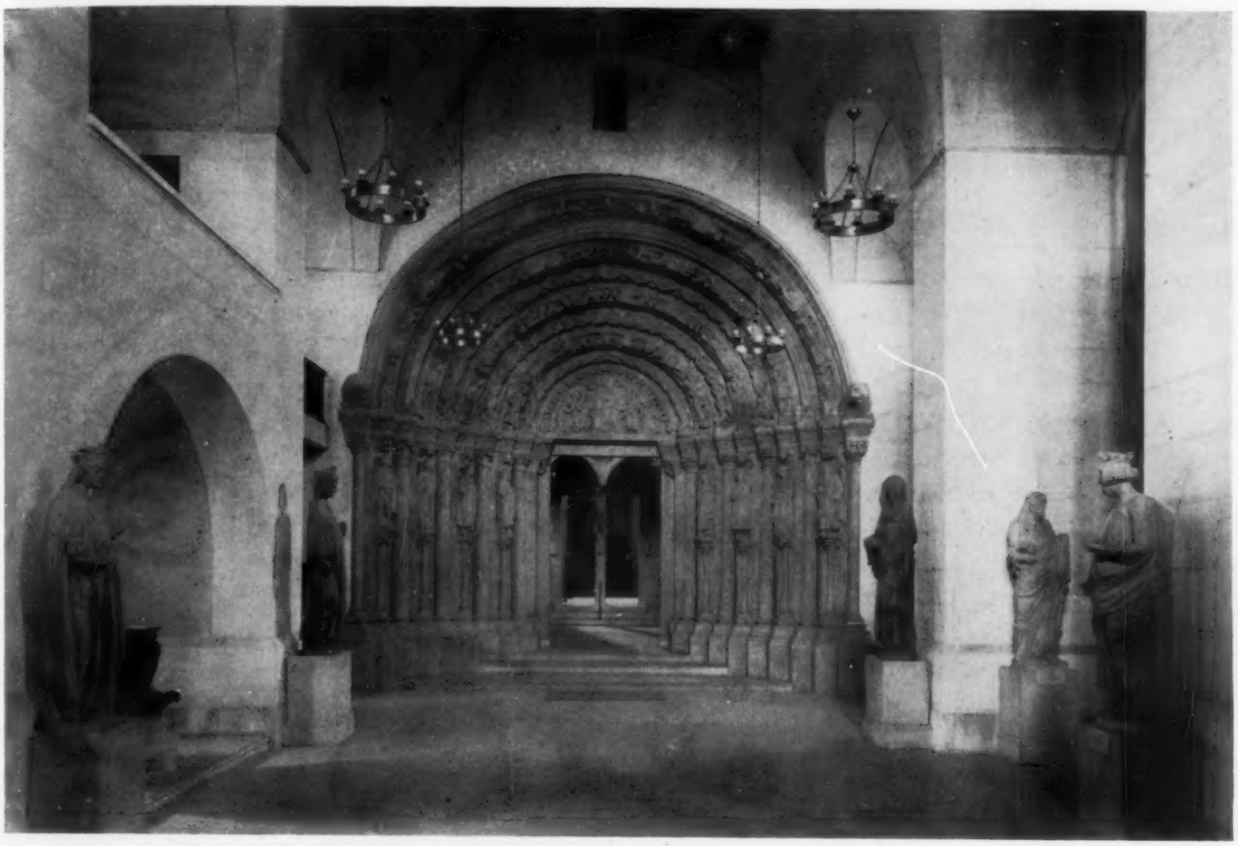




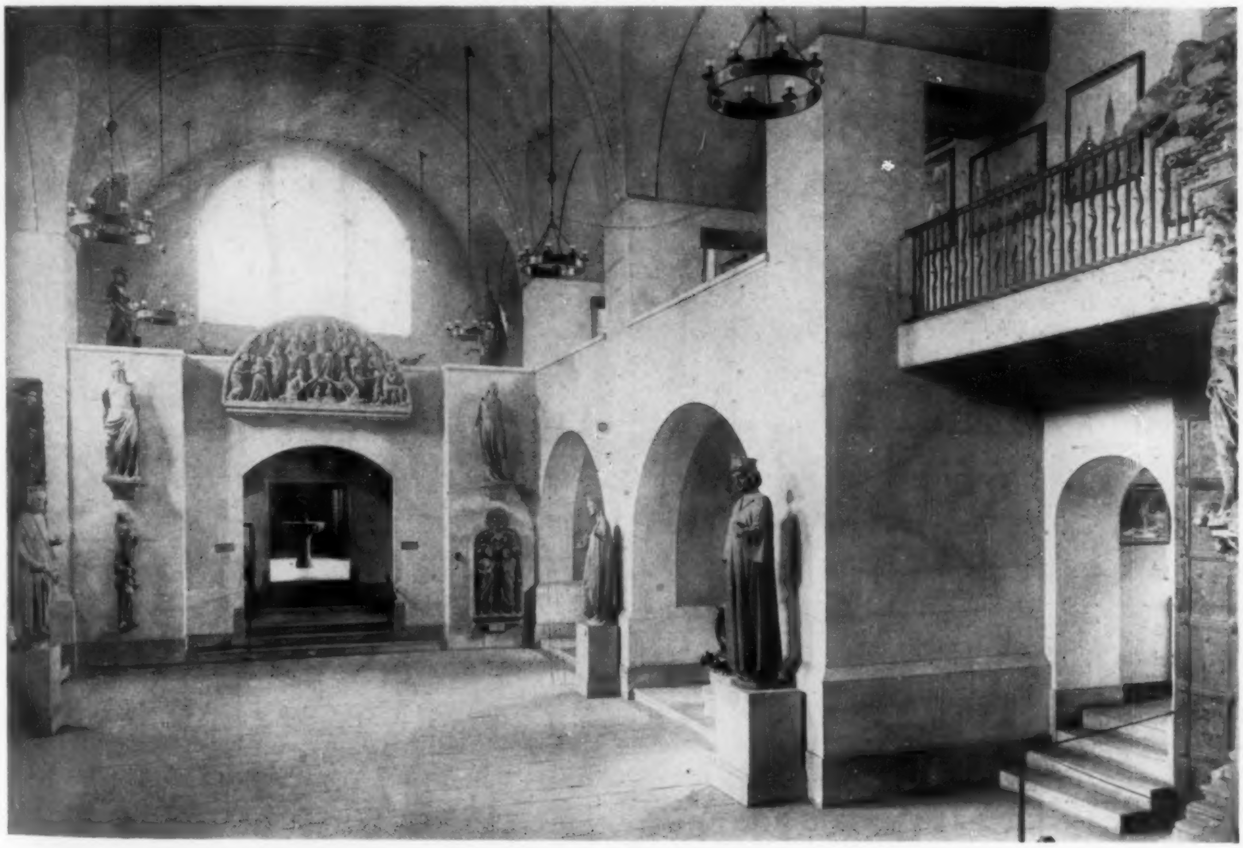
EAST AND WEST ELEVATIONS
GERMANIC MUSEUM, HARVARD UNIVERSITY
PROFESSOR G. BESTELMEYER, ARCHITECT
WARREN & SMITH, ASSOCIATED ARCHITECTS



GARDEN COURT
GERMANIC MUSEUM, HARVARD UNIVERSITY
PROFESSOR G. BESTELMEYER, ARCHITECT
WARREN & SMITH, ASSOCIATED ARCHITECTS



NORTH END OF ROMANESQUE HALL



SOUTH END OF ROMANESQUE HALL

GERMANIC MUSEUM, HARVARD UNIVERSITY

PROFESSOR G. BESTELMEYER, ARCHITECT

WARREN & SMITH, ASSOCIATED ARCHITECTS

chiefly the Renaissance Hall, stretches from Divinity Avenue to Frisbie Place. The inner sides of the angle formed by them, together with the arcades just mentioned, form the enclosure of the decorative court. A terrace on the roof of the lower story of the Renaissance wing offers a particularly charming view of the details of this court, with its shrubbery, its stone water basin and balustrades, and its bronze replica of the Brunswick Lion. At the junction of the two wings there rises a massive tower of the full width of the wings, diminishing above the roof in receding stages, until at the height of 102 feet it ends in a crowning octagonal cupola. This tower more than anything else serves to hold all the parts of the structure together,—a structure marked by a happy combination of diversity and unity, of picturesque and monumental strength.

There is no lack in the exterior of the building of suggestions of the various epochs in Germany's art development. The round arch frieze, articulated by vertical bands, forms the prevailing ornament of the Romanesque tower, the chapel shows vaguely Gothic outlines, the window frames of the Renaissance wing in a general way suggest sixteenth century patterns, and there are classicist reminiscences in the pediment over the Divinity Avenue entrance. But nowhere is there over-emphasis of these differences of style; nowhere is there direct imitation of any particular work of the past, and nowhere are there sudden clashes of form. Light transitions and modifications of decorative detail lead from one type to another. The whole exterior constitutes one central conception and not an accumulation of unrelated parts.

Still more impressively does this harmonious blending of one central idea with a great variety of individual forms manifest itself in the interior of the building. Everywhere is there seen the attempt to suggest by the architectural construction some particular phase in the development of style. Everywhere the most important of the casts are used as organic parts of the structure. Everywhere there exists an atmosphere transporting the visitor into the spirit of the time from which each of these works of art arose. That there is a constant change of floor level as well as of height between the different rooms contributes to making the whole interior, like the outside of the building, appear larger and more monumental than it actually is. From a low vaulted passageway, suggestive of early mediæval convent corridors and containing a collection of Byzantine, Karolingian and Ottonian fictile ivories, a few steps lead down to the Romanesque Hall, about 40 feet in width and 60 in length, with an arched ceiling about 25 feet in span, intersected by four arched openings. Into the wall opposite the entrance there is fitted the cast of the Golden Gate of the Cathedral of Friedberg, in Saxony, through the opening of which a number of steps lead up to the next room, the Gothic Hall. This latter consists of two parts, an oblong transept and a hexagonal chapel, the two separated by a cast of the rood screen of Naumburg Cathedral. Thus the whole wing of the building, from first to last, presents the essential elements of a mediæval church, and the arrangement of all the various objects,—statues, tympanums, fonts, pulpits, choir stalls, tombs, crucifixion groups, etc., in what may be called the nave, side aisles, transept and choir, has a decidedly ecclesiastical and solemn effect. And yet, this church-like construction is not in any sense an imitation of a real church but rather an adaptation of ecclesiastical motifs to museum purposes, guided above all by the prime necessity of giving the visitor the opportunity to observe and study each of the exhibits in detail.

In a recent monograph on Bestelmeyer, the Berlin art critic, Fritz Stahl, has thus defined the characteristic quality of his style: "The combination of what serves the practical purpose with a higher element,—call it feeling or harmony or imagination or all of these together,—is perhaps Bestelmeyer's most essential trait. The rigid dogmatism of the most recent school of so-called pure objectivity is wont to look upon such a style as romantic or sentimental. We shall not be deterred thereby from calling it genuinely artistic and emphatically constructive. There has never been true architecture which did not desire to stimulate the æsthetic sense, the imagination, the soul. The great question is as to the fitness and the refinement of the devices for satisfying this desire. Bestelmeyer is particularly rich in such devices." From all that I have said about the Germanic Museum at Cambridge, it has become clear, I hope, that this building amply bears out the correctness of such words as these. Harvard University has every reason to be proud of possessing so worthy an example of the style of this German master.

It remains to say a few words about the man whose generosity made the carrying out of all these building plans possible,—the late Adolphus Busch, of St. Louis. Mr. Busch's was in many ways a remarkable personality. In every sense he was a man of large caliber. Passionately devoted to hard work and to business adventure, he was a royal spender and giver. He loved praise and honors, but was entirely free from petty jealousies and always ready to give due recognition to the achievements of others. He won the affection of all his workmen by his fatherly care for their well-being and his just appreciation of their needs. With a high sense of American citizenship he combined firm love of Germany, the country of his birth, and deep pride in her political and industrial ascendency. His patriotic hopes centered in seeing the United States and Germany leading the world in all higher public activities, and he was fully convinced that by endowing the Germanic Museum he was helping to realize this noblest dream of his life. It was a deserved tribute that at the hour of his funeral the City of St. Louis should have halted public and private traffic, and it was entirely fitting that the Corporation of Harvard University should have given to the building of the Germanic Museum the name "Adolphus Busch Hall."

ENTRANCE FRONT

Photos. John Wallace Gillies, Inc.

Plans on Back

GARDEN FRONT

HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.

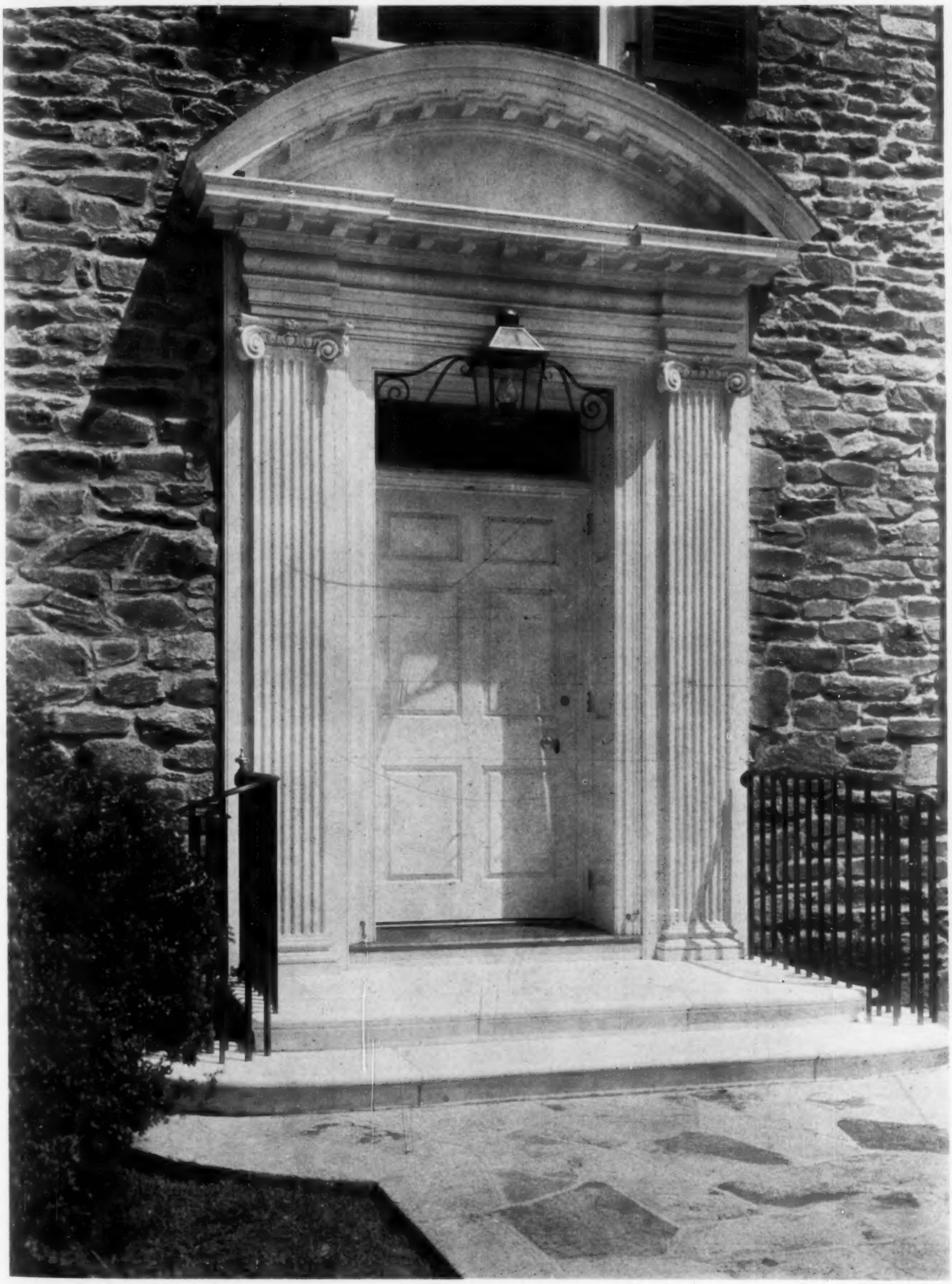
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

SECOND FLOOR

FIRST FLOOR

PLANS, HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.

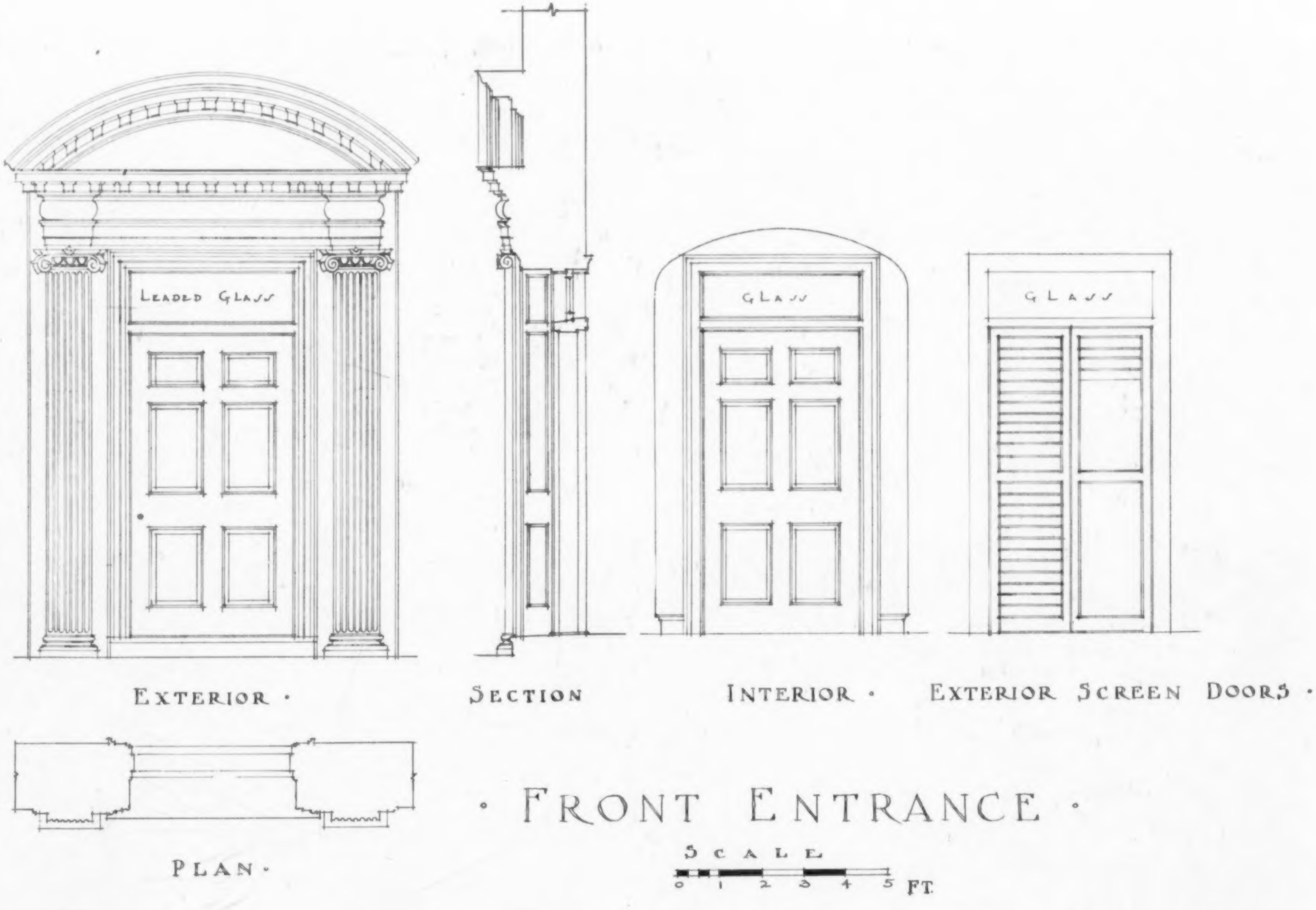
OFFICE OF JOHN RUSSELL POPE, ARCHITECT



Detail on Back

MAIN ENTRANCE
HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

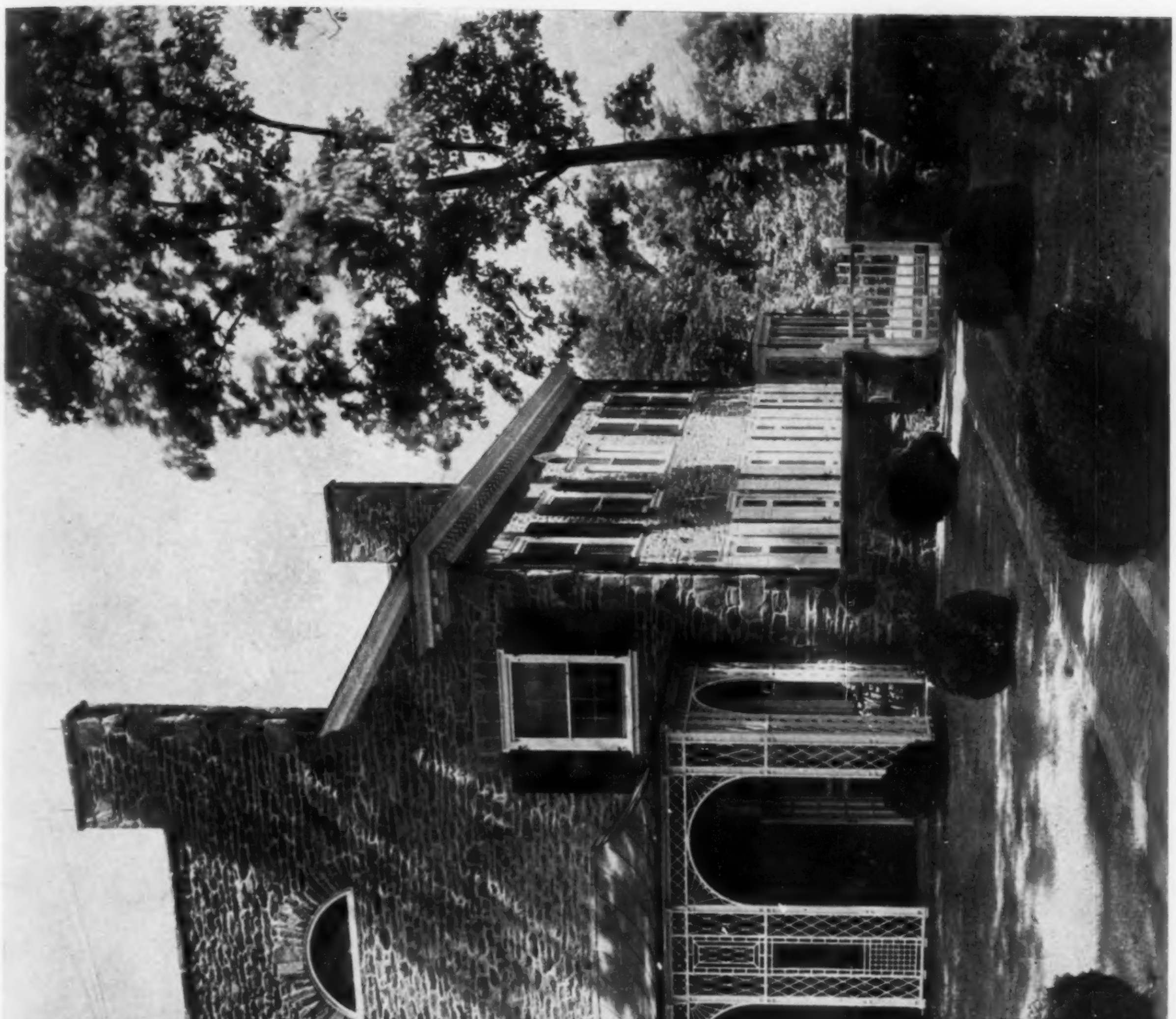
The Architectural Forum Details



Oct. 1928

HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

No. 80



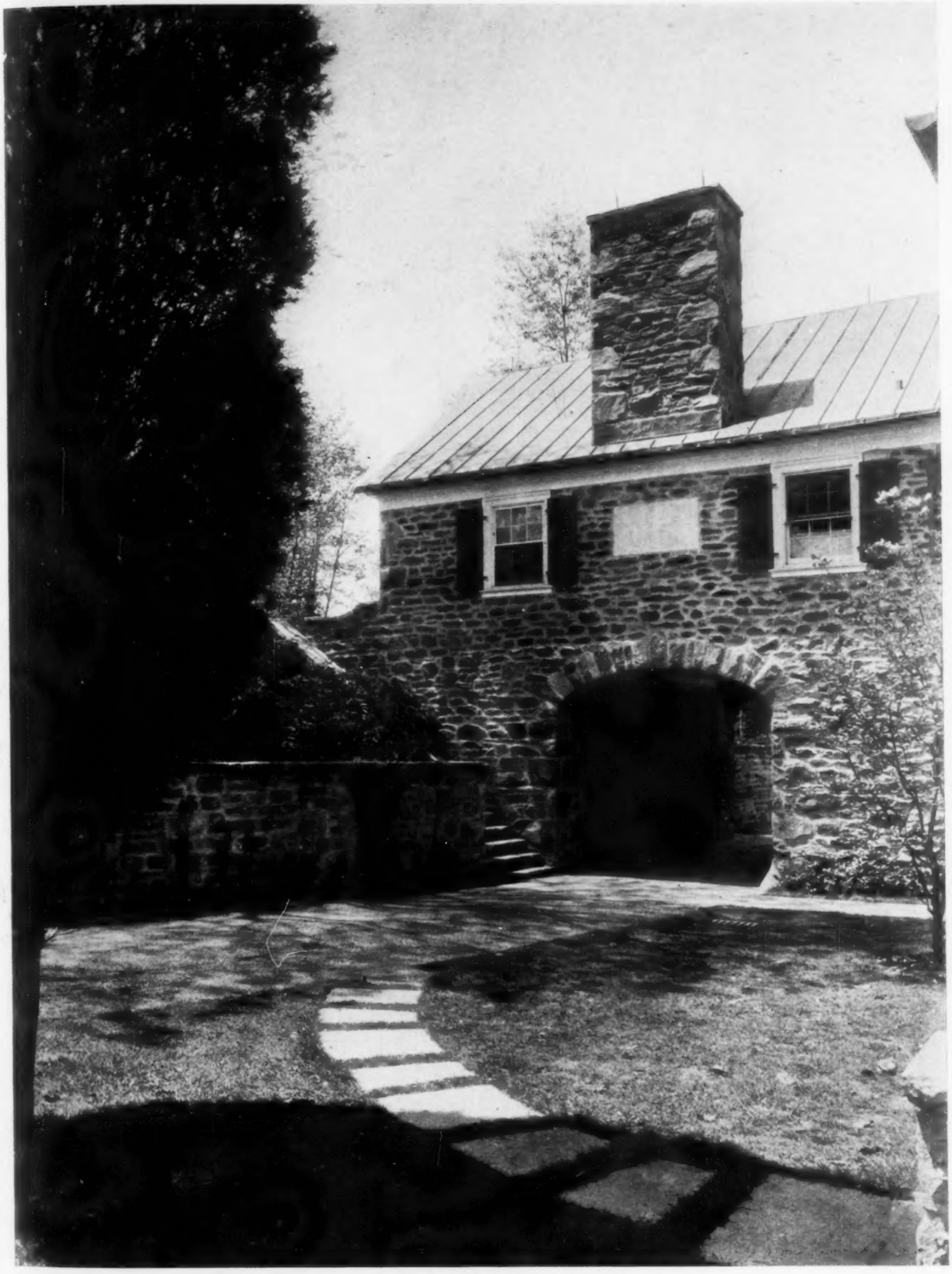
ONE END OF THE HOUSE
HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

GARAGE AND CHAUFFEUR'S QUARTERS

ENTRANCE TO CHAUFFEUR'S QUARTERS

ESTATE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.

OFFICE OF JOHN RUSSELL POPE, ARCHITECT



ENTRANCE TO GARAGE COURT
ESTATE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

FARMER'S COTTAGE
ESTATE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.
OFFICE OF JOHN RUSSELL POPE, ARCHITECT

ENTRANCE GATEWAY

GARAGE COURT

ESTATE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.

OFFICE OF JOHN RUSSELL POPE, ARCHITECT

DINING ROOM

ENTRANCE HALL

HOUSE OF JOHN F. WILKINS, ESQ., ROCKVILLE, MD.

OFFICE OF JOHN RUSSELL POPE, ARCHITECT

HOME OFFICE BUILDING FOR THE MUTUAL BENEFIT LIFE INSURANCE COMPANY, NEWARK

BY

JOHN H. & WILSON C. ELY, ARCHITECTS

THE problem of planning and designing a home office building for a large life insurance company is, first of all, a business problem. The conditions of such a problem demand a thorough understanding, from the first, of the business methods and requirements of the institution. The Mutual Benefit Life Insurance Company until lately occupied a fine building, one of the landmarks of downtown Newark. In the course of a comparatively few years the Company had outgrown these quarters, and demanded more space for its business, with room for future growth to take care of a fairly certain rate of increase. It could be quite definitely estimated, knowing the size of each department, what would be the size of that department at the end of, approximately, a ten-year period. The property the Company had purchased required moving from the heart of the city to a location in an outlying section. More "elbow room" was thus to be provided. This, however, demanded an absolutely complete building,—one which would provide the employes with all requirements, such as dining rooms, rest rooms, gymnasium, etc.,—every convenience and comfort.

A careful study was made, first of all, by the architects, of the business and methods of the Company as a whole; next, a study of each department in the same manner,—the locations of the departments, those most directly in contact with the public, those most directly in contact with the administration, and those whose main service is with distant outside agencies, and also departments which function directly in connection with the social and physical welfare of the employes of the Company. A carefully worked up scheme was first devised to provide a building of maximum size to cover as much of the lot as would be required for the Company's ultimate needs. It was determined how large a building was required to care for the present business, with room for growth over a pre-determined number of years. Then the portion of the scheme not to be built as a part of the present program was divided into definite divisions, to be provided after

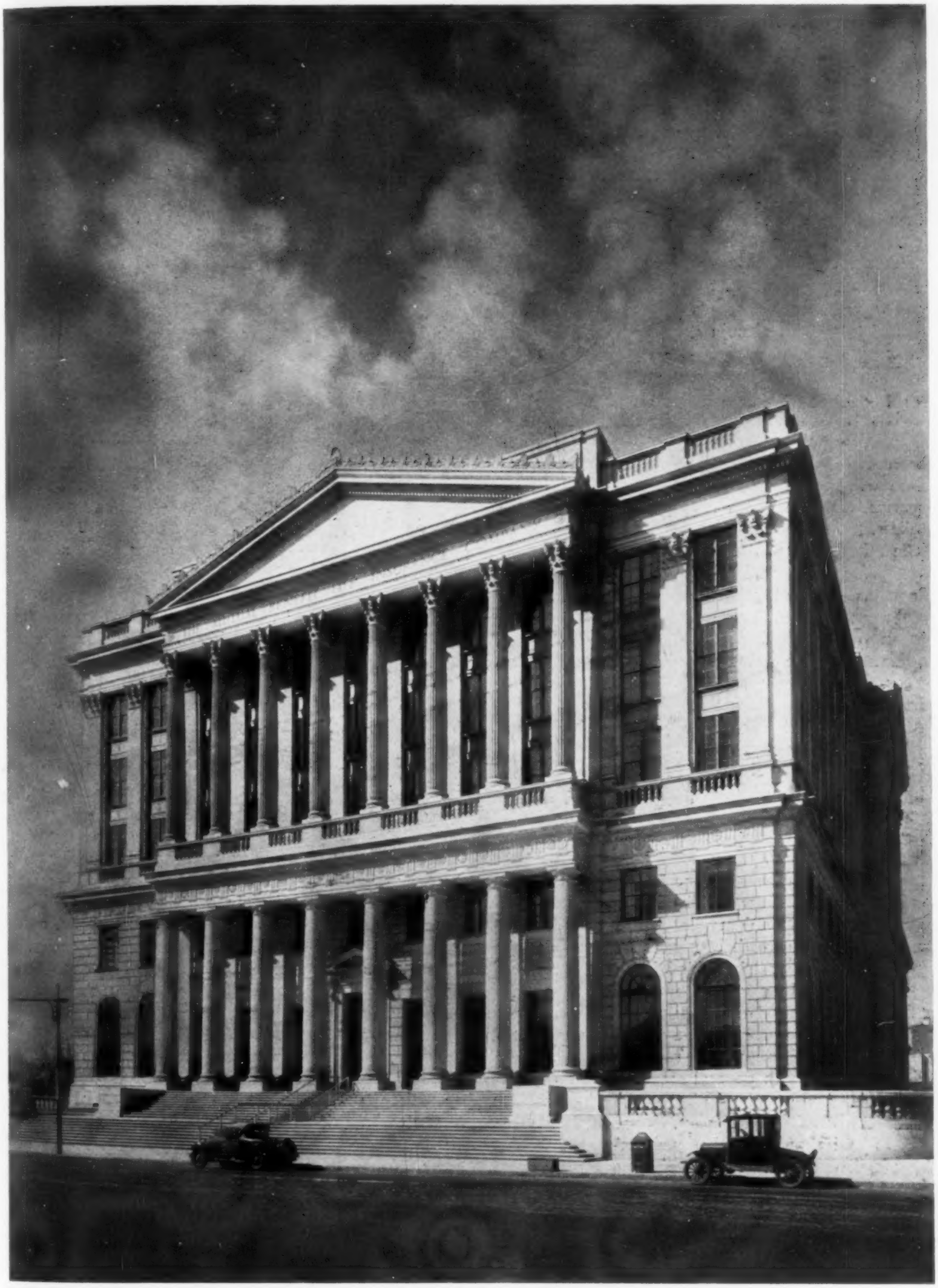
Photos. P. A. Nyholm

Main Corridor

Directors' Room

Mutual Benefit Life Insurance Building, Newark
John H. & Wilson C. Ely, Architects

AUDITORIUM
MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK
JOHN H. & WILSON C. ELY, ARCHITECTS

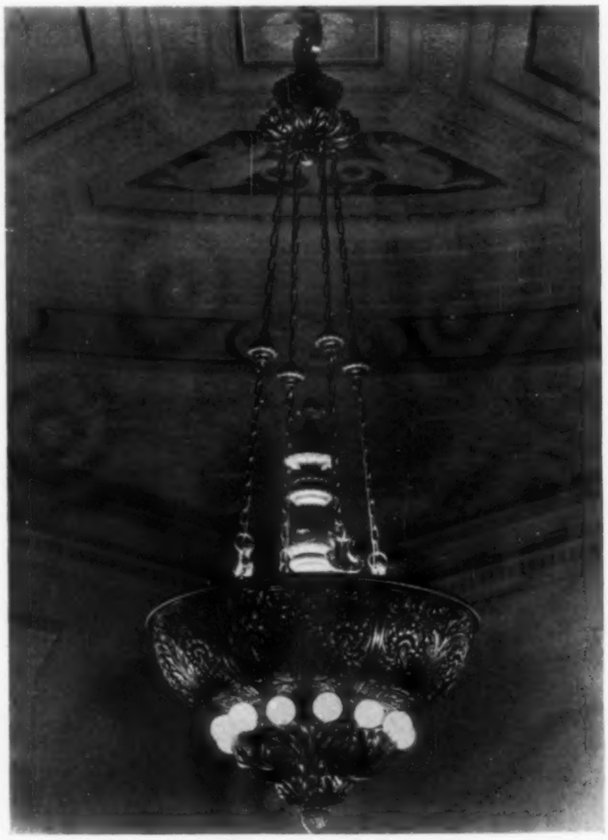


MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK
JOHN H. & WILSON C. ELY, ARCHITECTS

certain stipulated periods of time, following a well planned future building program. From this, the Company knew just where it stood, from the start of the new program well on into the future, in so far as building and equipment could be determined in advance. After the present and future were satisfactorily settled, that is to say when a present program which provided a workable future program had been made, the further detail work was devoted completely to the present building program to be undertaken.

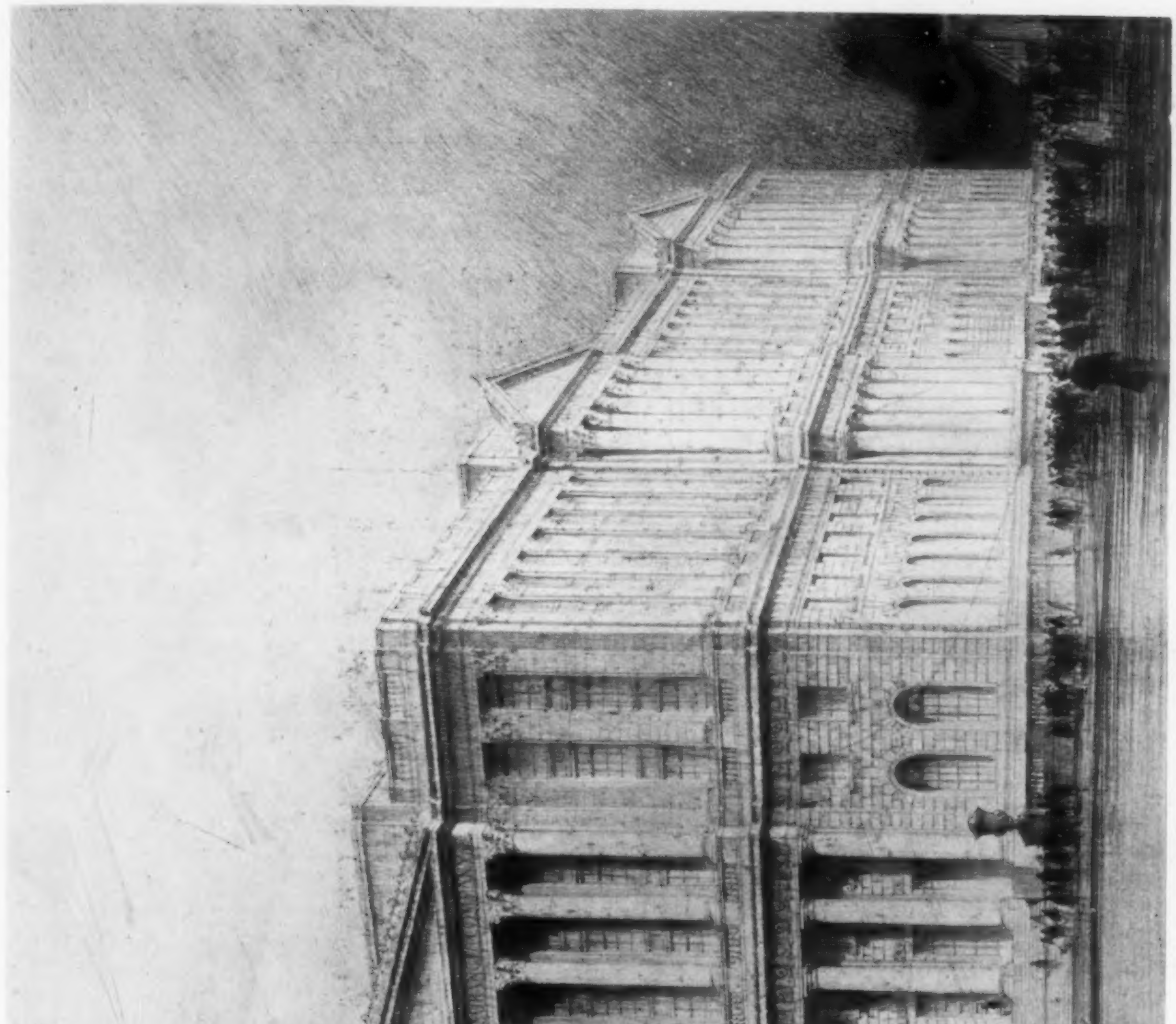
The structure was designed to provide a main building with two wings. The main building fronts on two important streets and is L-shaped, having a portico with several entrances on each street. One wing is devoted to service, such as elevators, toilets, locker rooms, etc. The other wing provides rooms for social activities, such as an auditorium and a gymnasium. There is an outlying building, adjacent to the service wing, but entirely separate from the main building, which houses a boiler plant for heating the entire structure. A study was made of the problem of elevator service to get employes from the street to their work and back again with the least amount of delay and the most efficiency. The plan provides for 12 cars; for present demands six were considered enough, but as growth continues under the present roof, other cars will be added in shafts now ready to take them. In a general way the basement provides for vaults and record files, with a large shipping and receiving room, a laundry, fan room, printing room, furniture repair room, and house electrician's room, with general service rooms of a like nature, a gymnasium,—fully equipped,—providing a standard basket ball court, four bowling alleys, lockers and showers and a visitors' gallery. This floor is also used for dancing upon certain occasions.

The first floor of the main building has two wide corridors, crossing at the center under a rotunda. On this floor are located the departments most in contact with the outside world. The elevator lobby is directly off the rotunda, flanked on each side with staircases. The auditorium is located in the service wing directly over the gymnasium, and it is so planned that it may be entered directly from the street without entering the main building. The floor and balcony of the auditorium together seat 1,000 people. The stage is thoroughly equipped to take any modern theatrical production, and has ample dressing room accommodations. The second floor is devoted to executive offices and board room, with mathematical and legal departments. In addition to the utilitarian rooms in the service wing, two dining rooms are provided for the Company's officers, with a serving pantry connected by a lift with the kitchen on the top floor. The balcony of the auditorium is not connected with the main building on the second floor level, save by a roof. A large outside motion picture booth is provided. The third and fourth floors have large open working areas for departments. The fifth floor provides a new business department with laboratory, doctor's rooms, and examination rooms used in connection with the work of examination of physical specimens, etc. used in connection with proposed new risks. The top floor is devoted mainly to a large dining room, with kitchen and pantry service. One wing is given over to infirmaries for employes, with male and female wards, this space being directly over the doctors' rooms below. Outside the dining room, back of the parapet, is an open tile roof, which is used as an outdoor promenade. The grounds about the building are laid out to provide automobile parking area as well as driveways.



Chandelier in the Rotunda

As far as the architectural treatment of the building is concerned, the architects desire to pay their respects to the monumental structure which the Company was obliged to vacate because of the growth of its business. It was of a past period of American architectural design, but a wonderful example of the best of that period, and it was an inspiration to have it to "live up to." In the new building it was felt that the architects had to express the strength of a large, important American business enterprise with the dignity and scale obtained by using a large but simple type of Classic architecture. This was their endeavor. But, after all, the judgment of the successful solution of any architectural problem rests with those who view the building and with those who use it,—and not with its architects.

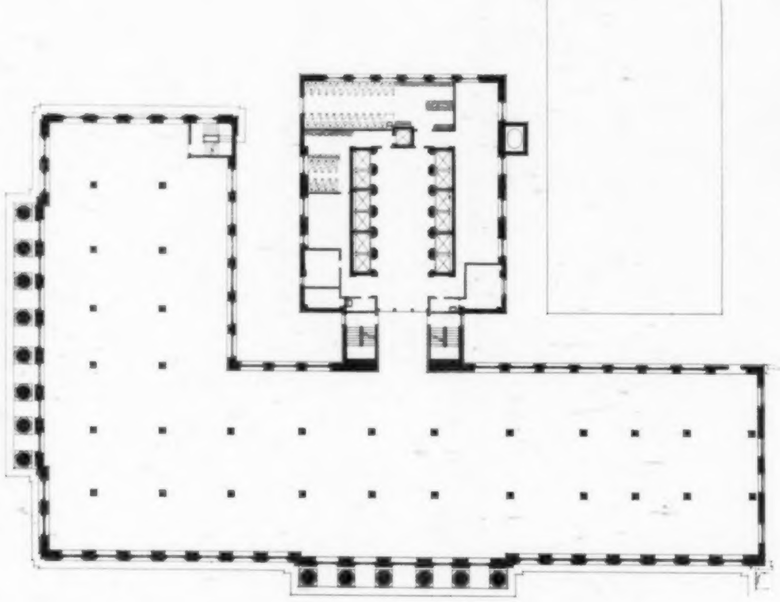


From a Rendering by Chester B. Price

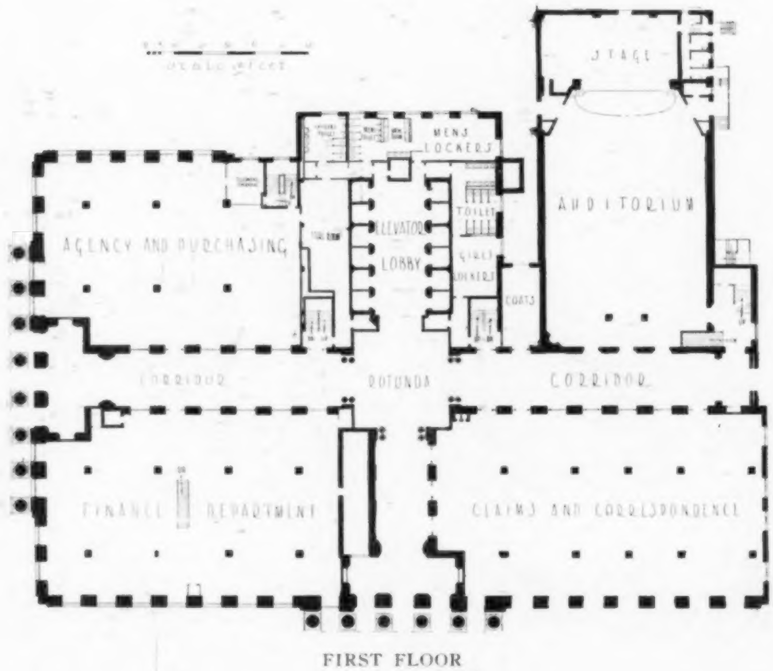
MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK

JOHN H. & WILSON C. ELY, ARCHITECTS

Plans on Back



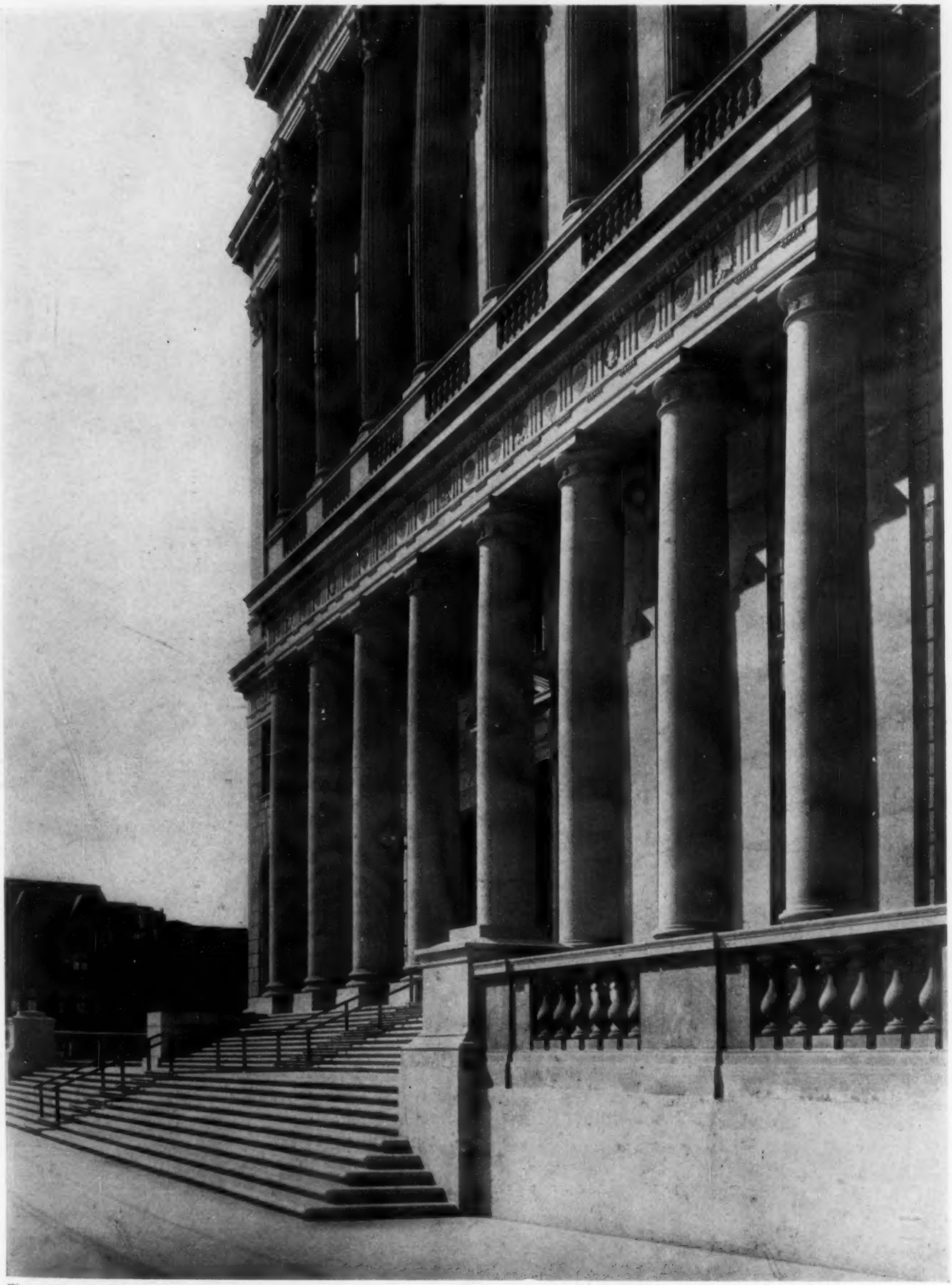
A TYPICAL FLOOR



FIRST FLOOR

PLANS, MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK

JOHN H. & WILSON C. ELY, ARCHITECTS



Photos. P. A. Nyholm

ENTRANCE PORTICO
MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK
JOHN H. & WILSON C. ELY, ARCHITECTS

ROTUNDA

MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK

JOHN H. & WILSON C. ELY, ARCHITECTS

ENTRANCE VESTIBULE
MUTUAL BENEFIT LIFE INSURANCE BUILDING, NEWARK
JOHN H. & WILSON C. ELY, ARCHITECTS

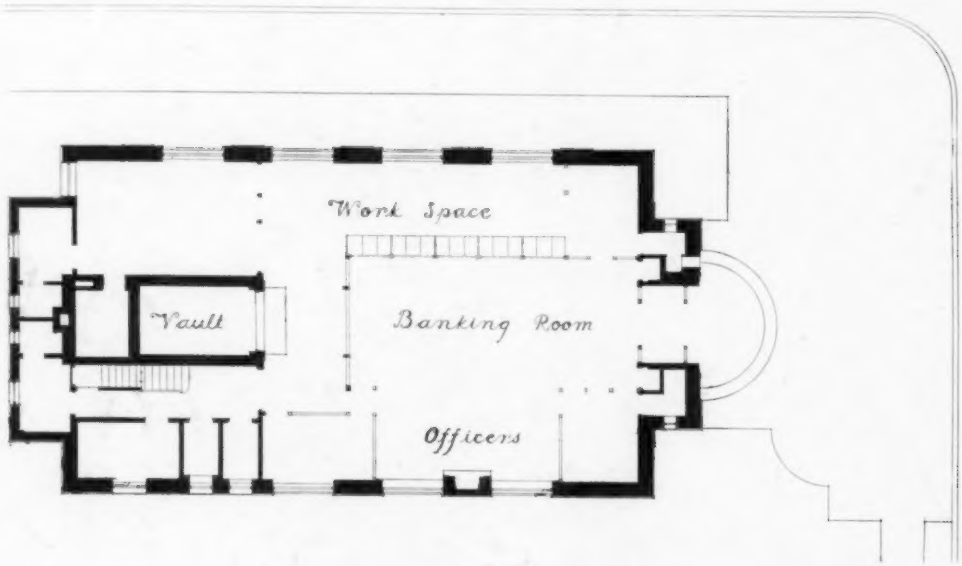
Photos. William M. Rittase

GENERAL VIEW

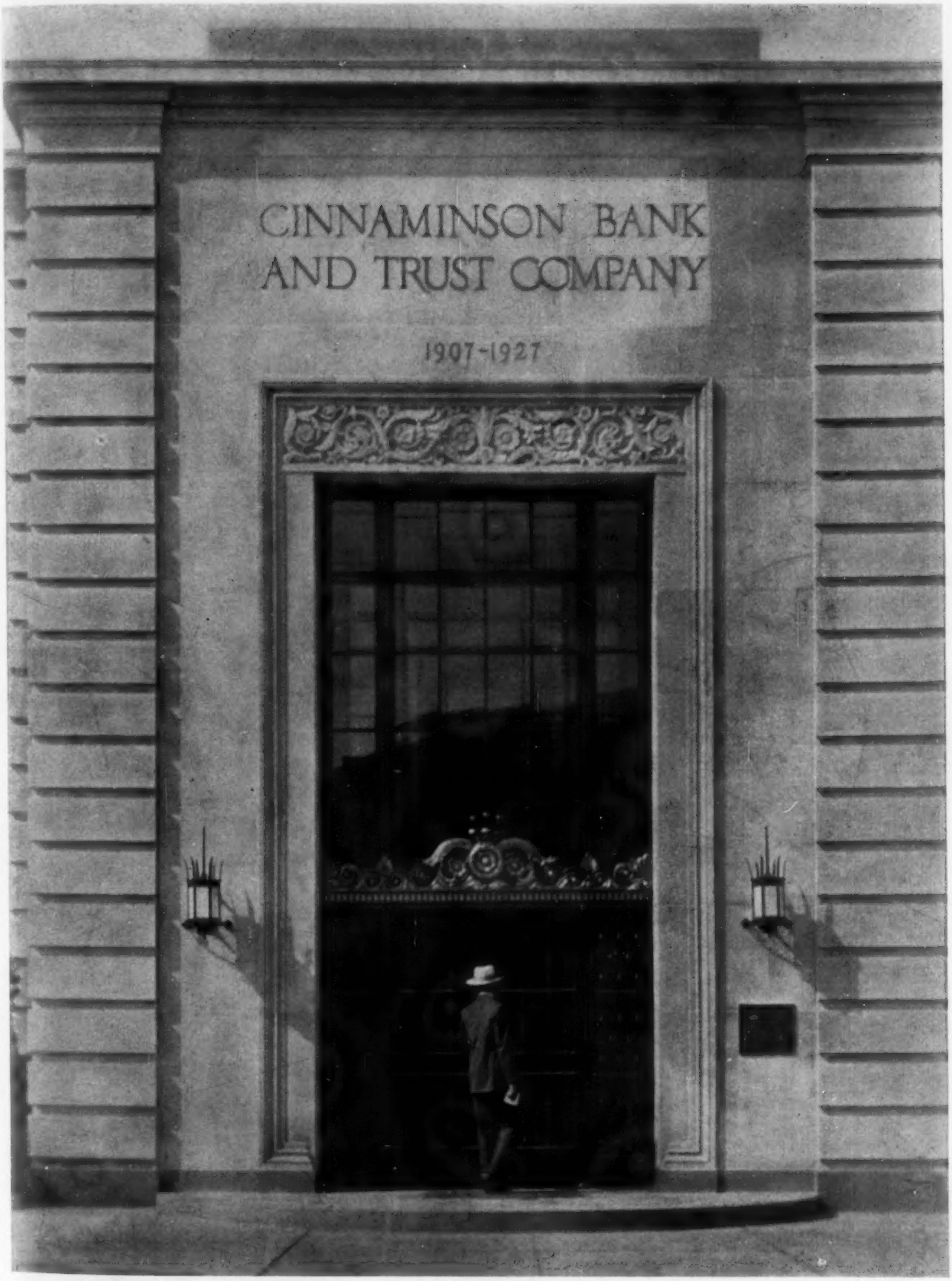
CINNAMINSON BANK AND TRUST COMPANY, PHILADELPHIA

DAVIS, DUNLAP & BARNEY, ARCHITECTS

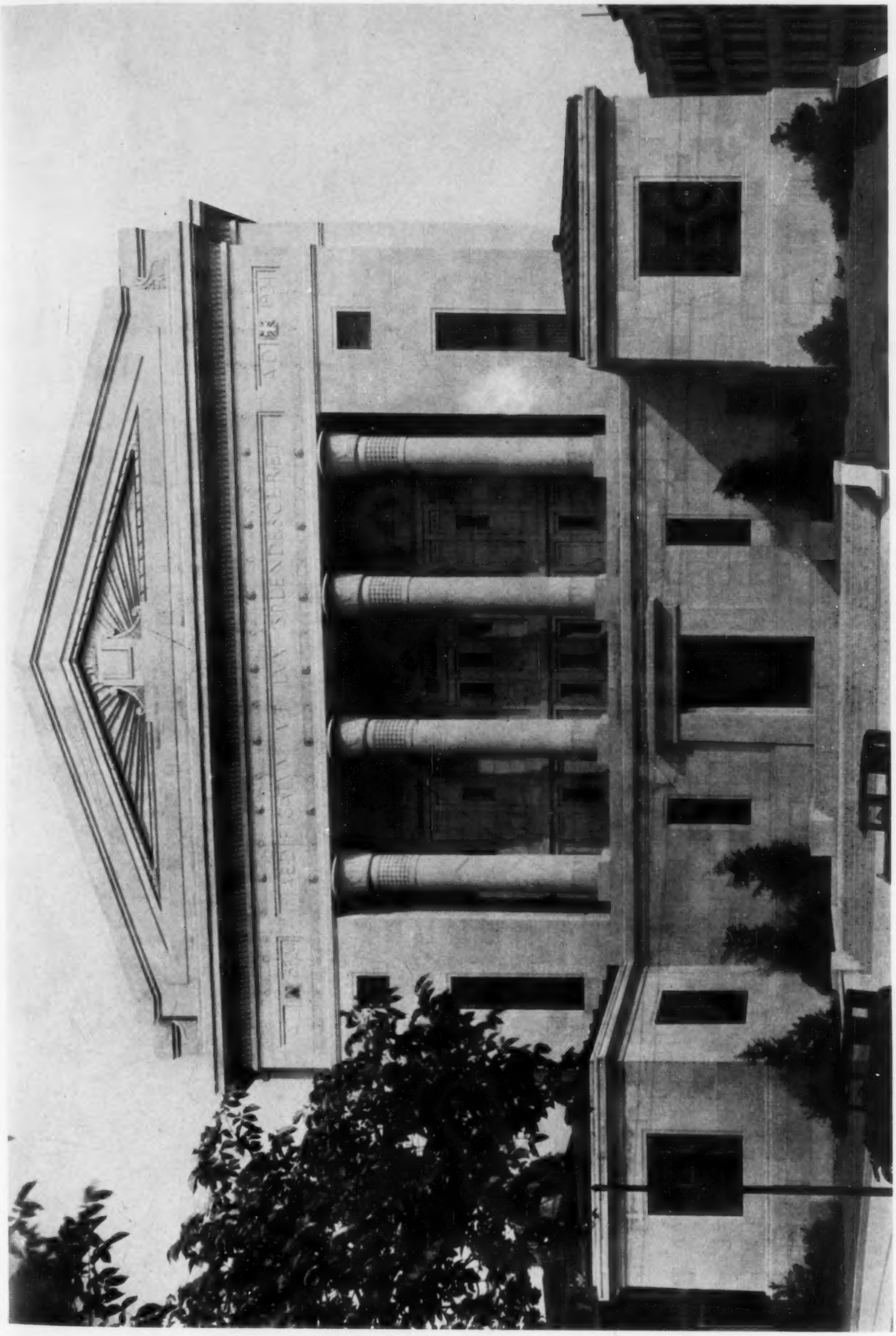
Plan on Back



PLAN, CINNAMINSON BANK AND TRUST COMPANY, PHILADELPHIA
DAVIS, DUNLAP & BARNEY, ARCHITECTS

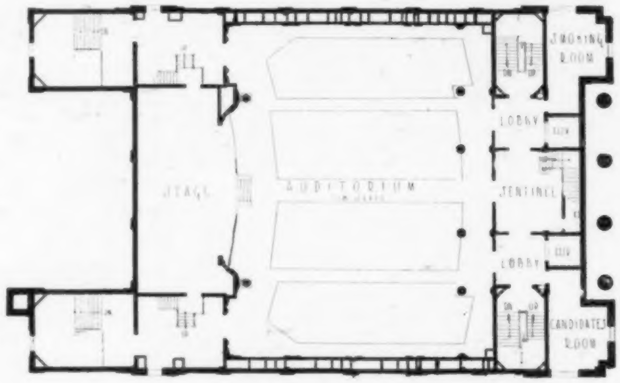


ENTRANCE DETAIL
CINNAMINSON BANK AND TRUST COMPANY, PHILADELPHIA
DAVIS, DUNLAP & BARNEY, ARCHITECTS

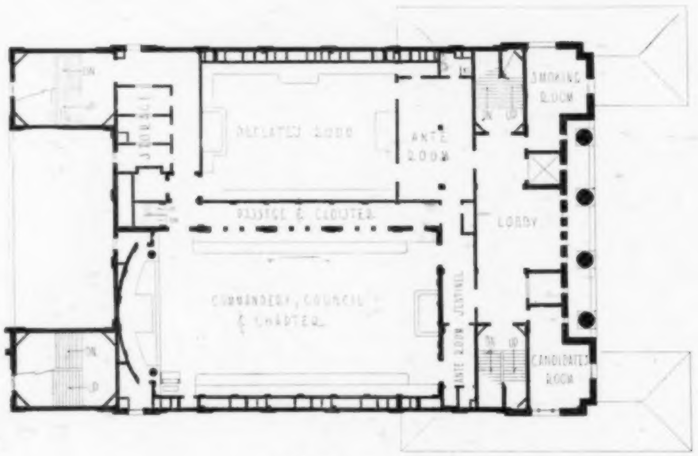


Photos. Paul J. Weber

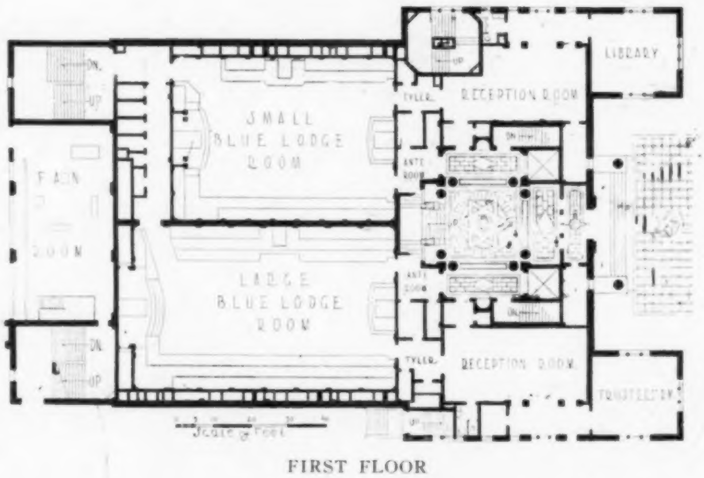
MASONIC TEMPLE, SPRINGFIELD, MASS.
McCLINTOCK & CRAIG, ARCHITECTS



THIRD FLOOR



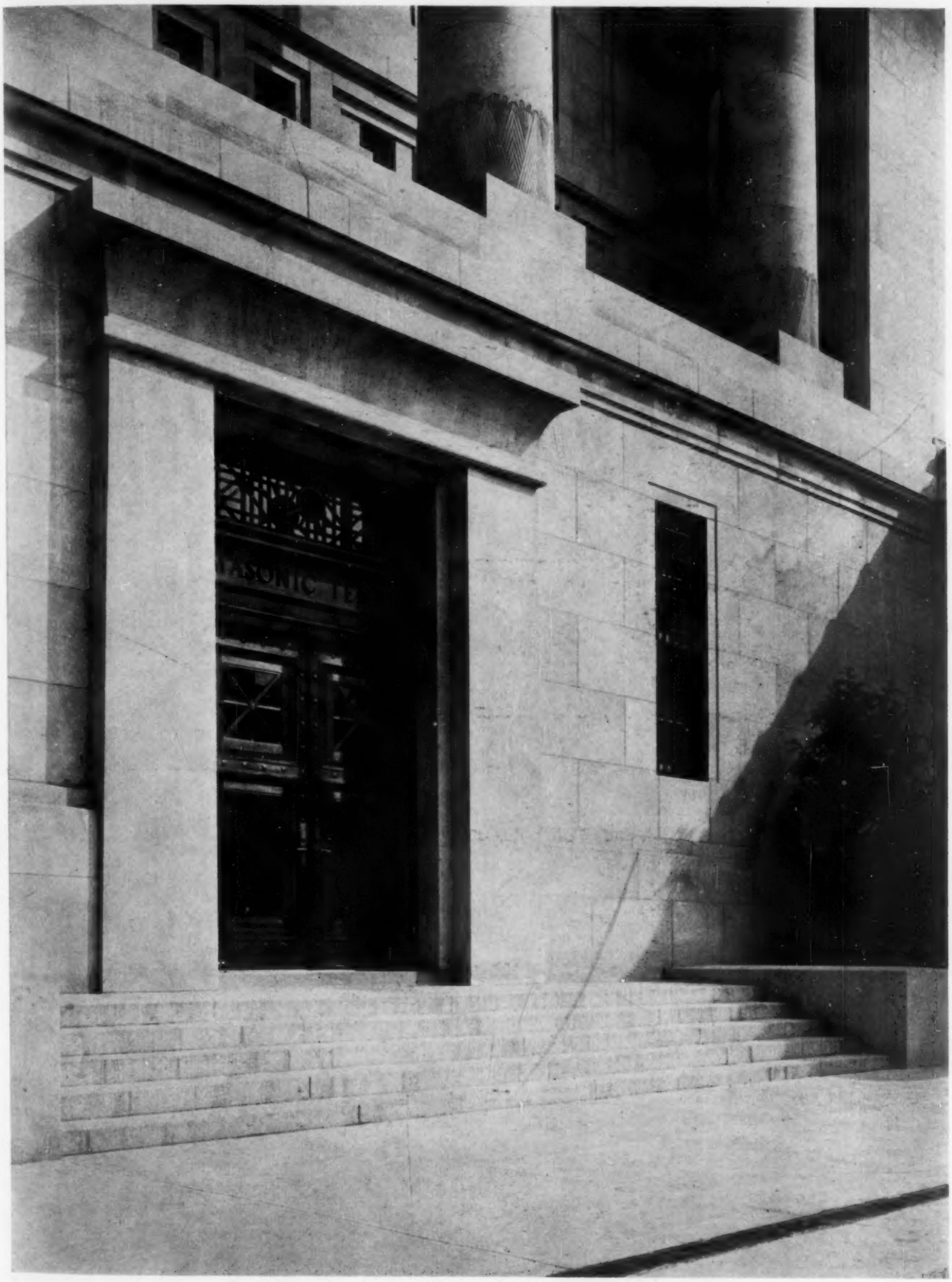
SECOND FLOOR



FIRST FLOOR

PLANS, MASONIC TEMPLE, SPRINGFIELD, MASS.

McCLINTOCK & CRAIG, ARCHITECTS



MAIN ENTRANCE
MASONIC TEMPLE, SPRINGFIELD, MASS.
McCLINTOCK & CRAIG, ARCHITECTS

NORTH HILLS GOLF CLUB

BY

CLIFFORD C. WENDEHACK, ARCHITECT

THE trend of club house design and construction in the metropolitan district has been marked in the past five years by many innovations. Club houses are beginning to acquire "personalities," both as a result of the activities of the memberships and the type and design of the buildings, for it will be found upon careful study that the characters of different memberships vary as much as the characters of individuals with regard to their habits, tastes and general modes of living. The North Hills Golf Club has something of this personality, for it is situated on one of the highest spots on Long Island, with gently rolling hills and sandy soil, suggesting in its general character portions of provincial Spain. It seemed but natural that the Spanish style be employed, with an idea that the Spanish atmosphere could be created in the immediate vicinity by landscaping. Another governing factor making for the employment of this style was the type of the club's membership, which demanded a comfortable atmosphere accompanied with dignity for personal entertainment as well as a background on a par with the best hotels in the South, and a reminder, during the golfing season, of the play days spent at America's greatest winter resorts. The advertising sense of the times was also a contributing factor, since it was found that a building erected on such a prominent site would be visible for many miles over the surrounding country. The orange and red roof is proving this to be the case, for the tower treatment over the grill has already become a distinguished landmark.

Club house planning in recent years has been entirely revolutionized, primarily because golfers' requirements have grown by leaps and bounds until the frame of mind at the present time of new building committees is such that they are not contented unless their clubs possess more in many ways of convenience and size than their neighbors'; larger lockers, more area in their dressing room accommodations, and commodious showers, form a basis of their demands. The popularity of the club house as a scene of entertainment has increased tremendously during the last few years, with the men, and still more with their wives,—as it is considered more economical and more convenient to entertain at a club than in one's home. The popularity of the game with women in general has perhaps tripled the number of active women golfers throughout the country during the past five years, until their separate demands and the extent of their accommodations have become almost as great as those of the men. These factors alone have been responsible for the ever-increasing costliness of an up-to-date club structure and have caused many interchangeable relations of the component parts of the building.

The proper relation of the building to the golf course has also become an important factor. The handling of great numbers of cars and the starting and finishing of men and women golfers in close succession throughout the golfing season make it

From a Rendering by the Architect

North Hills Golf Club, Douglaston, N. Y.
Clifford C. Wendehack, Architect

Grill Room Fireplace

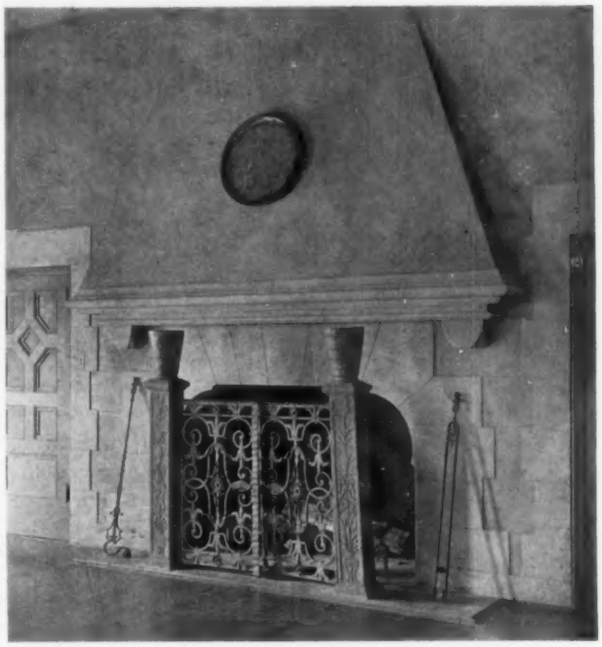
imperative not only to have the locker rooms in close proximity to the starting points of the course and the parking space for comfort, but also to have the porches and living portions of the club properly orientated for shade and prevailing breezes. A close study of the North Hills plan in relation to the course reveals how conveniently it is related to the first and tenth tees, with an ideal position for the ninth and eighteenth greens within full view of the porches and terraces. This close relation of the home greens to the building not only saves much unnecessary walking but is an actual factor of safety in crossing roads, and a money-saver with regard to guests on the starting time. This was made possible by the preliminary coöperation by the course architect and the architect for the building, and it demonstrates most satisfactorily what can be done when building committees heed the advice so often given them by both architects to let them work out the problem together before planning of either course or building assumes form.

The main entrance to the North Hills club house is protected by a stone *porte cochere* which opens directly into a vaulted lobby, adjoining which are

Photos. Kenneth Clark

Lounge, with Dining Room Beyond
North Hills Golf Club, Douglaston, N. Y.
Clifford C. Wendehack, Architect

the office, coat room, women's room and main stairs, and the women's entrance leading to their quarters and lockers on the second floor. Opening from this lobby there is a wide loggia which affords means of communication to the grill, dining room and lounge which are arranged in such a manner that they can be converted into one large area for entertainment, thereby economizing space under normal conditions and affording ample room for large gatherings on special occasions. An unusual effect, which adds to the spaciousness of the lounge, is the two-story hall treatment with its clerestory windows and decorative trusses. At one end is a huge fireplace, and a gallery at the side overlooks the entire floor area. Porches are provided to the west and south of this room, connected with flagstone terraces extending past the dining room and completely encircling the grill, permitting the dining and drinking out of doors so much in vogue. The locker room is placed at an angle from the main club house in order to connect directly with the first tee and to obtain a southeast exposure for the main building. It may be entered from the main hall or from the spacious men's lobby directly from the



Dining Room Fireplace

Entrance Lobby, with Dining Room Beyond
North Hills Golf Club, Douglaston, N. Y.
Clifford C. Wendehack, Architect

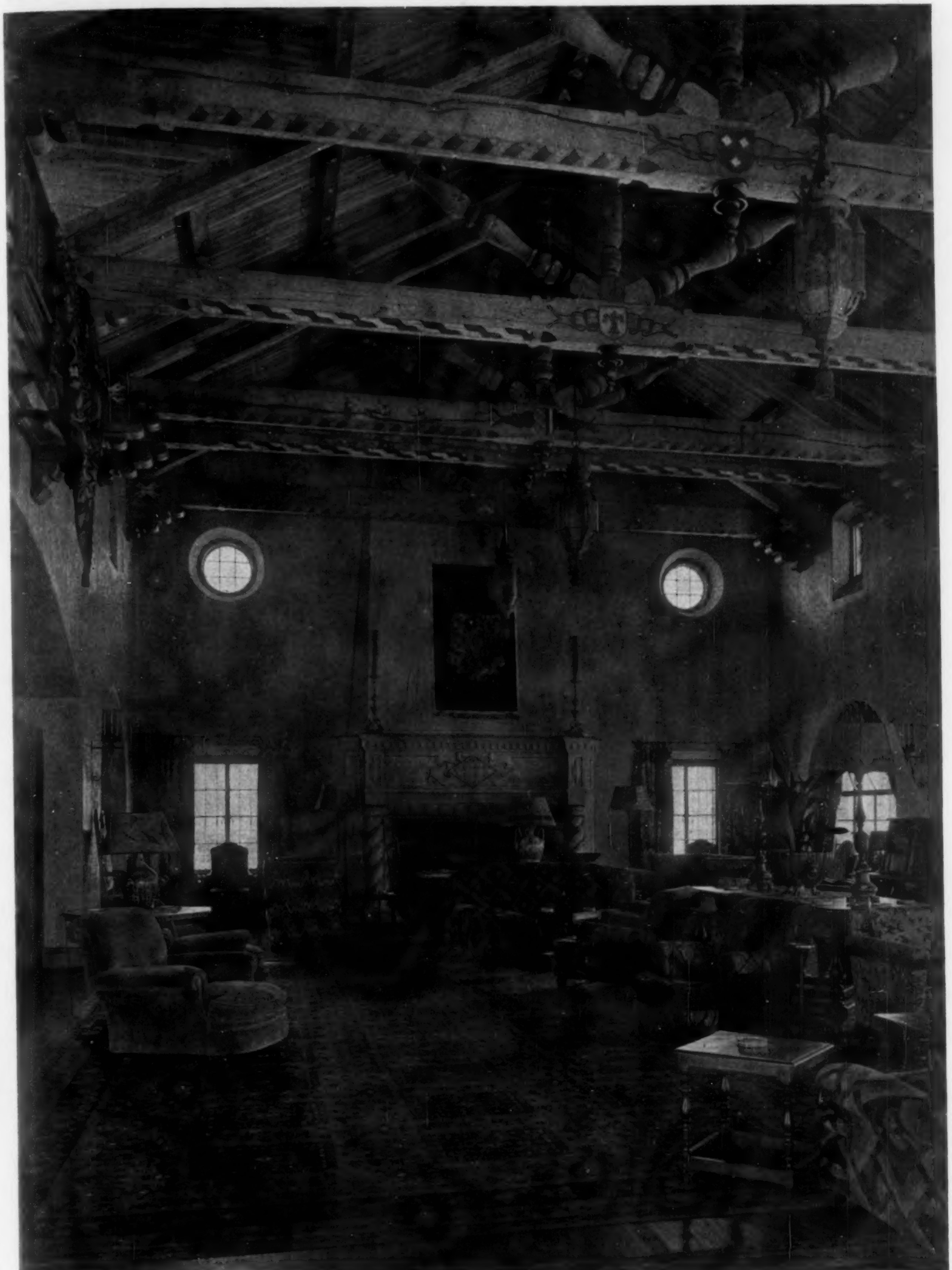
main driveway. This separate entrance for the men will prove a very popular feature. It is octagonal in shape, and from each of its eight sides is an opening leading to the men's locker room, coat room and wash rooms. Over the first floor is a wide light well running the entire length of the locker room, and directly over this is provided a continuous row of skylights. Ventilation is provided over each row of lockers and around the entire roof area, making an unusually light and freshly aired room. A covered loggia or porch is provided on the second floor as well as on the first. It is furnished with card tables and easy chairs for golfers who wish to lounge about in informal attire.

The vista down the loggia illustrates better than any words can do the relationship between color of material and forms. The loggia furnishes the keynote for the entire club and was inspired by the old hospital at Vich, Catalonia. The floors of this room are of dark red and yellow tiles, highly polished. The walls are rough hand-made plaster and are treated dead white with old style kalsomine. The ceiling is antiqued rough lumber with brilliant orange, blue, green and black stencils. The colors of the floor, walls and ceiling are recalled in the draperies and pieces of pottery, which latter form not only spots of color but, being filled with sand, are ideal for ash receivers. While the ensemble is startling and usually calls forth an exclamation of surprise, it is restful and extremely cool in effect.

The lounge and dining room express the general result obtained by contrasting scale of rooms. The effect of coziness in the dining room and spacious freedom in the lounge affords a contrast which makes for an unusual atmosphere at social affairs. Here the color key is carried to its highest pitch, starting with the coloring of the antique drapery over the balcony and in the carpet which is of brilliant oranges, yellows and blues. The two Spanish iron grilles separating these rooms are removable when the rooms are thrown into one. The dining room probably contains more color, both in the room proper and on the tables, than has ever before been attempted in club decoration. The walls are rough, bumpy plaster antiqued to a mellow orange hue. The beams are natural wood color, decorated in blues, greens, whites and blacks, and they blend into the walls, except for their ornamentation. The ceiling is a green-blue, recalled again in the chair coverings, which are peacock green. The unusual use of arm and side chairs develops an atmosphere of informality. The table coverings are natural Spanish linen, furnishing an ideal background for the colorful Deruta china of individual designs and various colors. The mantel in this room focuses all its color on the Spanish horseman plaque, done in the same color as the wall, and the antique Renaissance fire screen. The novel use of wrought iron gates with stone supports in place of a fire screen, creates a new note in fireplace treatment.

The men's grill is truly masculine in its scale and simplicity of treatment. The brown and orange floor is an excellent resistant to hob nails. The rough plaster walls are treated with soft green tones, which are recalled in the beam treatment of the ceiling. The huge fireplace on the left burns 5-foot logs, whose warmth can be felt throughout the room. The cloisonne vases on the fireplace shelf frame a fine piece of Spanish mosaic in tones of black, white, red and green, with a gold field containing the names of the officers who were associated with the erection of the building. The stairway to the left of the main entrance, leading up to the women's lounge and locker rooms on the second floor, is constructed of red tiles and black marble treads with iron handrail and twisted balusters. It is a feature which is interesting without being ostentatious. The white walls of the loggia are continued out into this lobby and on the second floor. A novel adaptation of a bulletin board, so often an unsightly object in the main entrance, is secured by the use of an old Spanish mirror frame with cork board insert for posting notices. It admirably serves a utilitarian function.

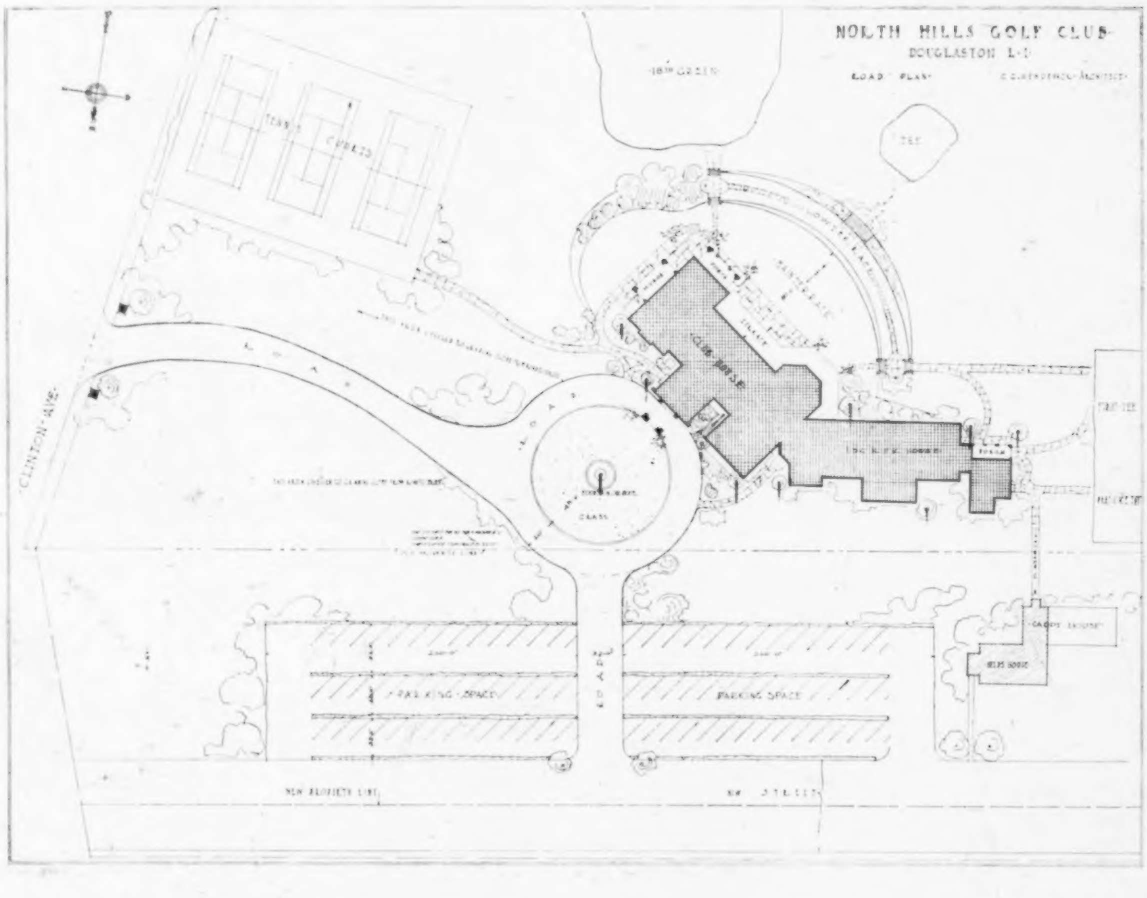
The inspiration and benefits to be derived from rich coloring and correct forms in club buildings are at last being recognized as an important factor in their success. The atmosphere created by color and form unconsciously affects the frame of mind of every club member, producing within him, at its best, satisfaction and poise, which will be reflected not only in his improved score on the course, but in the general harmonious attitude toward his fellow members and the employes of the club. Scientists declare that color is a positive force which affects our nervous systems, probably by an electrochemical activity, and that all persons with normal eyesight feel its influence. This influence is based upon the stimulation of the senses which results when white light, broken by reflection into its various wave lengths, falls upon our vision, so that instead of somber grays we see varying hues which appear to add a kind of vitality to forms. Each hue exerts its particular effect upon us, and the impression is so specific that even animals and insects appear to have marked preferences for certain colors which seem to affect their behavior. The ideal state of mind produced by right color environment must be assisted by a smooth working of all practical parts. The sequence of rooms, their sizes, character and functioning must unconsciously serve the members with ease and convenience. Economy of steps, speed, and the certainty of having every want immediately supplied at their command must be assured before their æsthetic natures can be appealed to. The North Hills Golf Club's building committee realized this fact and permitted the architect and decorator a free hand in determining the layout of the plan, the character of the various units and the color combinations, in fact they were permitted to use more color in a bolder manner than up to the present time has been done in club work. The result is original, bold, and highly interesting.



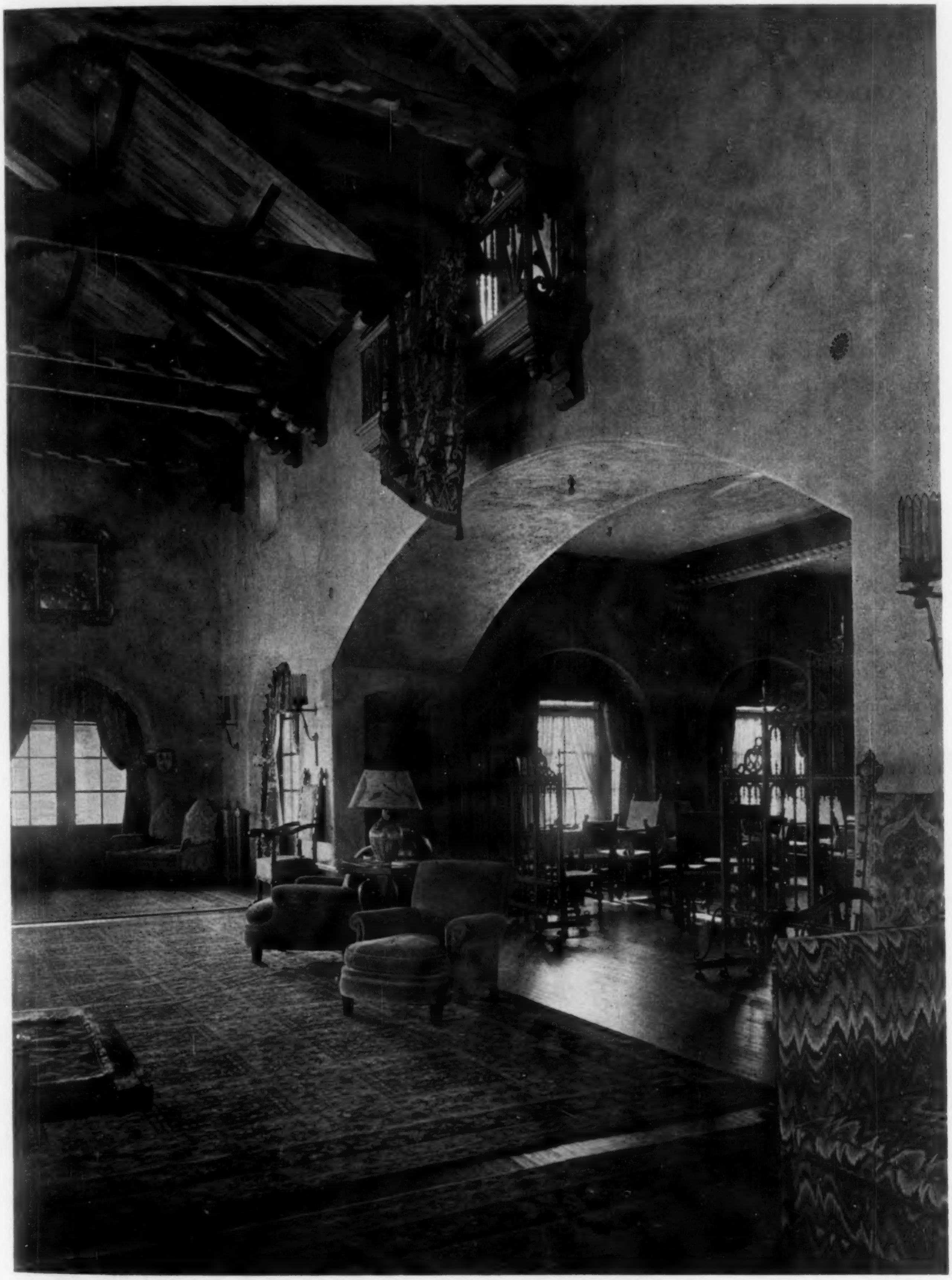
Photos. Kenneth Clark

Plan on Back

LOUNGE
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT

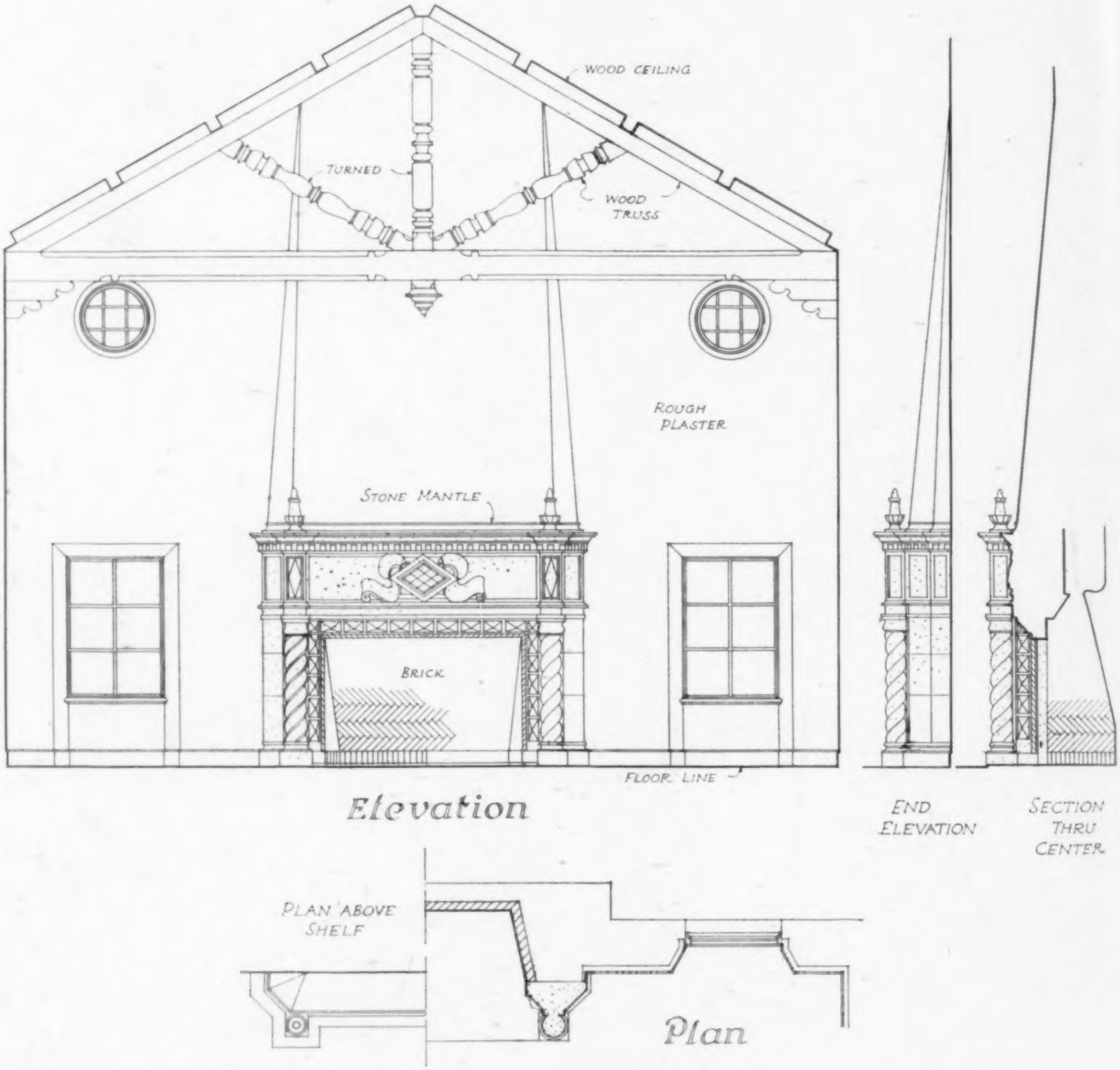


PLOT PLAN, NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT



ARCH BETWEEN LOUNGE AND DINING ROOM
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT

Detail on Back



LOUNGE DETAIL

NORTH HILLS GOLF CLUB DOUGLASTON, LONG ISLAND N.Y.

C. C. WENDEHACK, ARCHITECT, NEW YORK CITY

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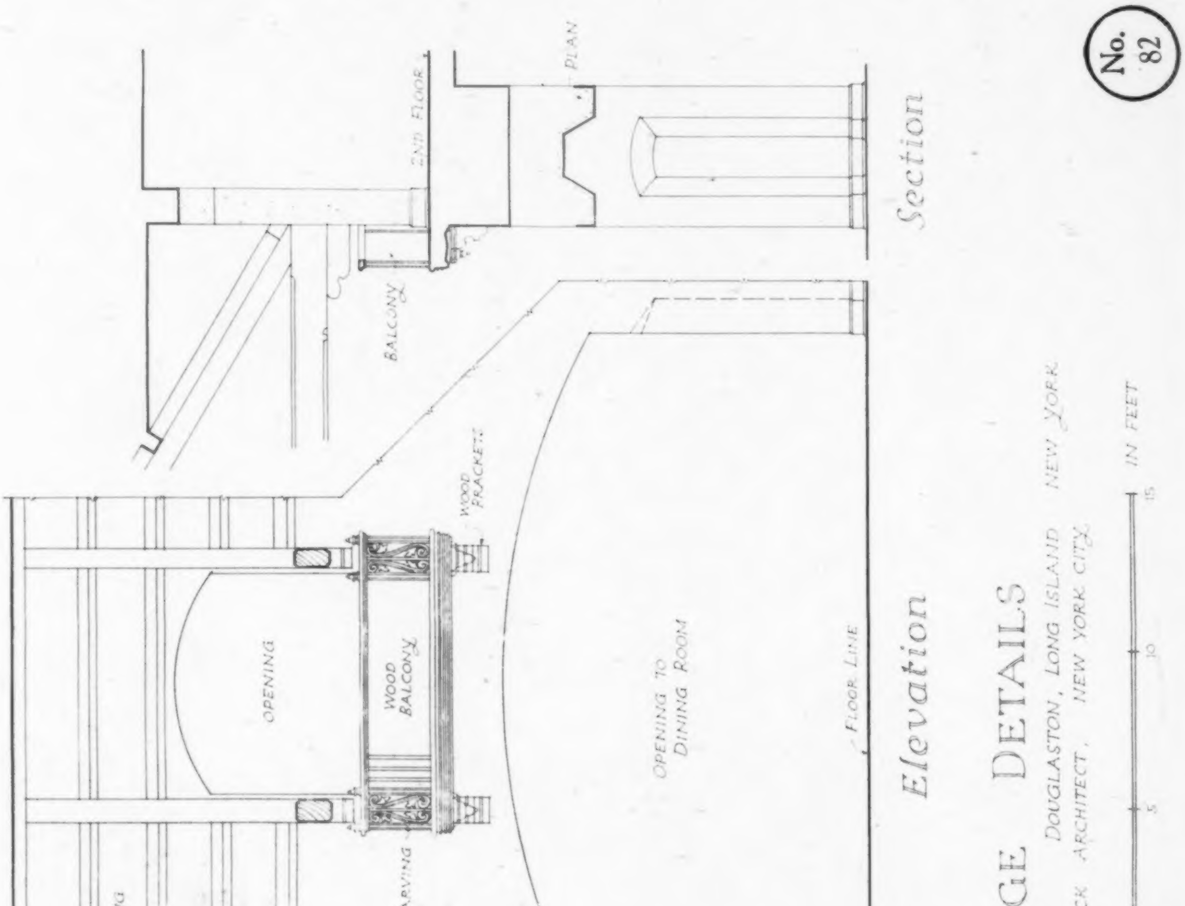
SCALE IN FEET

OCT. 1928

No. 81

Detail on Back

STAIRWAY TO WOMEN'S LOUNGE
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT



No. 82

LOUNGE DETAILS

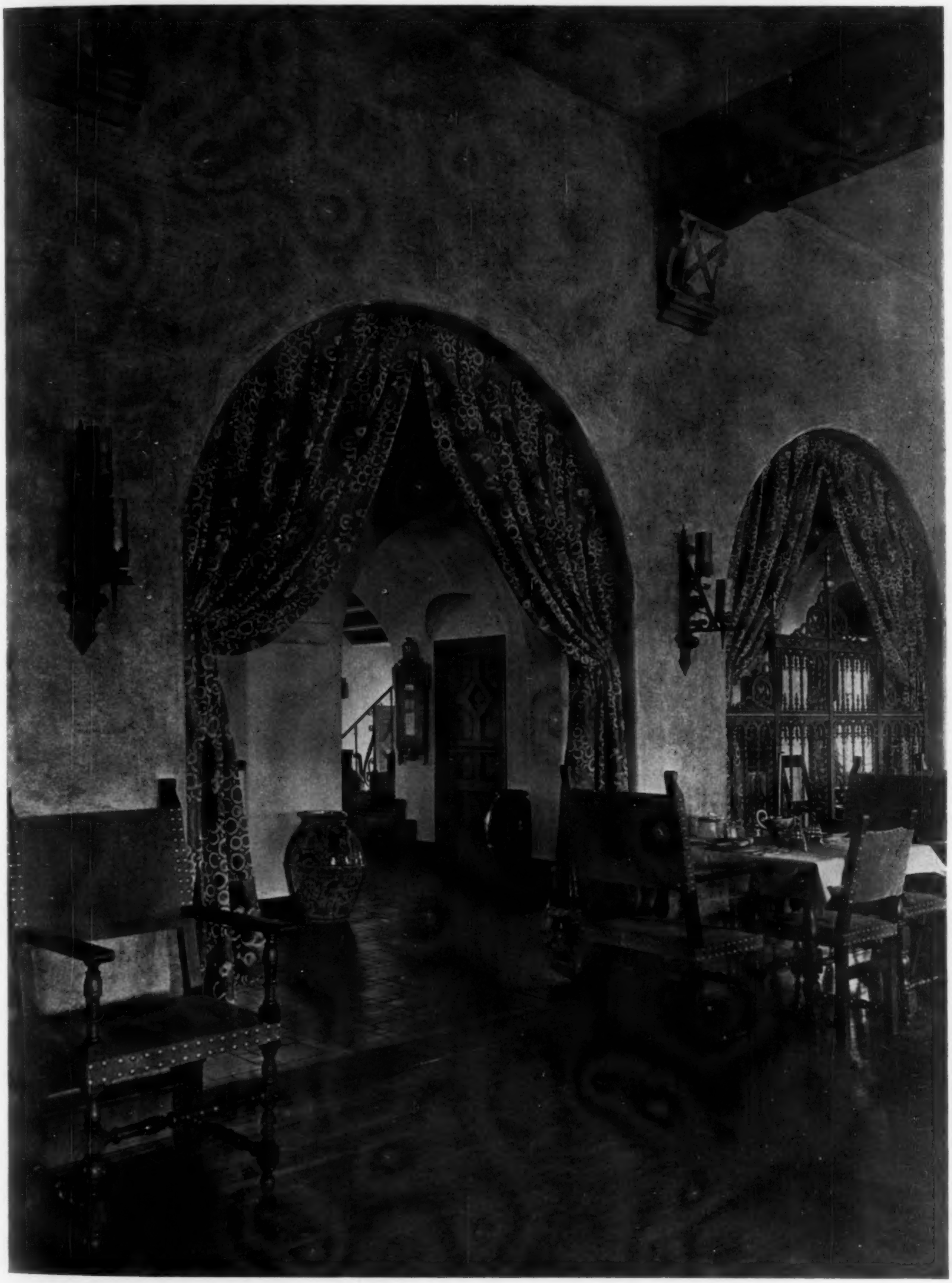
NORTH HILLS GOLF CLUB, DOUGLASTON, LONG ISLAND NEW YORK
C. C. WENDEHACK ARCHITECT, NEW YORK CITY

OCT. 1928

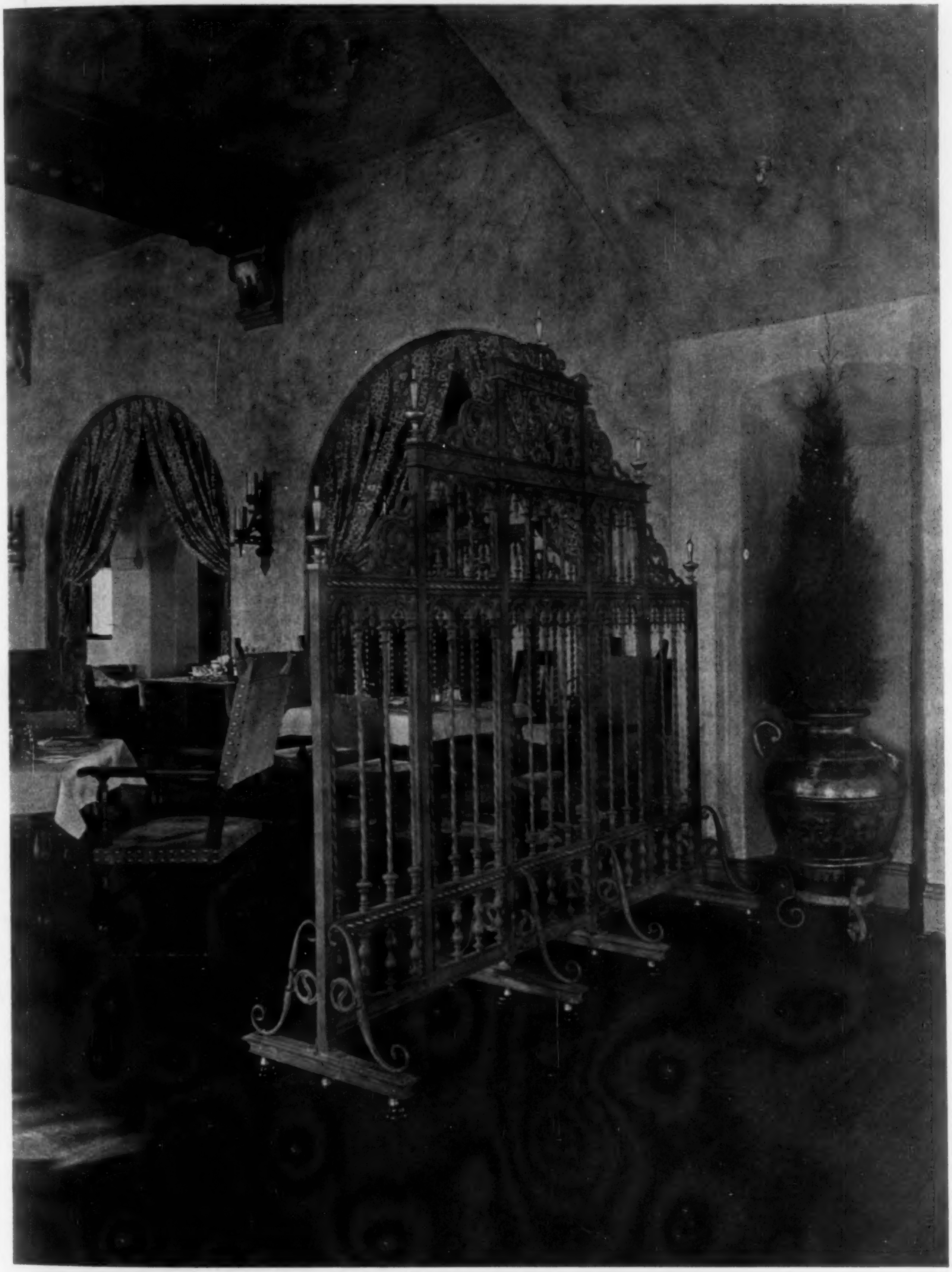
The ARCHITECTURAL FORUM DETAILS

DINING ROOM, FROM LOUNGE
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT

LOGGIA
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT



ENTRANCE HALL, FROM DINING ROOM
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT



WROUGHT IRON GRILLE BETWEEN LOUNGE AND DINING ROOM
NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.
CLIFFORD C. WENDEHACK, ARCHITECT

DINING ROOM

MEN'S GRILL ROOM

NORTH HILLS GOLF CLUB, DOUGLASTON, N. Y.

CLIFFORD C. WENDEHACK, ARCHITECT

SANTO DOMINGO

THE SITE OF THE COLUMBUS MEMORIAL

BY

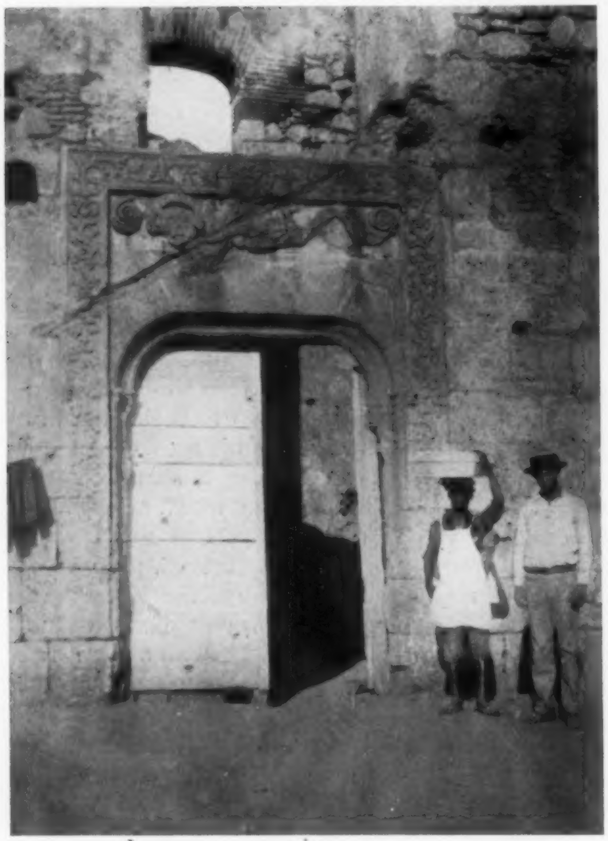
EDWIN LACLEDE HOWARD

FROM Porto Rico, which is four days' journey from New York, an overnight trip on the boat brings one to the old Spanish colonial city of Santo Domingo, the capital of the Dominican Republic and the site of the Columbus Memorial Lighthouse, toward which the eyes of the architectural world will be turned during the international competition for its design and plan, which is very shortly to be held.

The boat leaves San Juan, Porto Rico, as the setting sun throws its last rays on the magnificent fortress at the mouth of the harbor, and when daylight comes again, the island of Haiti, the eastern three-quarters of which is held by the Dominican Republic, appears apparently floating on the water. The calm sea dashes itself with unexpected violence in long lines of breakers against the narrow strip of coral rock which forms the shore. There are few beaches, and the low cliffs are crowned with great palms and in the far distance, like vague clouds, there may be seen the outlines of mountains. The sun's rays beat down with a merciless intensity, which is somewhat relieved by the trade wind from the east, which, seemingly actuated by clockwork, starts to blow. Soon we come upon the mouth of the Ozama River and catch our first glimpse of the proposed location of the lighthouse and of the old city. To the east of the river, a strip of coral rock, bearing palms and other large trees, pushes its way out into the white breakers and the marvelously blue sea. Save for the gray, vine-clad ruins of an old chapel, there are no signs of human habitation. On the west bank are one- or two-storied stucco houses,—pink, red, yellow and white, with pink predominating; here and there a low, dark mass of a church or monastery roof may be seen. To the west, the buildings dwindle away amid groves of cocoanut palms.

On the shore, still pounded by breakers, is the wreck of the U. S. S. "Memphis," a warning not to forget the West Indian hurricanes which sweep these shores during the summer months. Our ship anchors in the open roadstead, and a tiny launch, performing marvelous convolutions, carries the passengers toward the shore. As the river is entered, the memorial site, to the left, stretches along with a slight rise from the sea, deserted. The city becomes dominated by the fortress called the "Homage Tower," which was the chief bulwark of the old walled city. This tower was built when the city was moved from the opposite bank in 1503; the first settlement was by Don Bartolome Colon, or Columbus, brother of the discoverer, in 1486. An engineer-architect, Don Cristobal de Topia, came from Spain especially commissioned for the work, as the Spanish saw the need of having a stronghold in this, the governing city of

North Facade, Cathedral of Santo Domingo



Entrance, Casa Diego Colon

Doorway, the Old Mint

the Indies. Their judgment was confirmed, since later the wealth of Mexico and Peru flowed through this port on its way to add to the greatness of the old country. An illustration of this tower from the land gate is given on page 540.

The launch ties up before the gate of San Diego, illustrated on page 543. The wall is pierced diagonally by the gateway, which is surmounted by a curious moulding which curls itself up to be received upon a Spanish Renaissance motif. The gate is a scene of much activity. Along the quay are small freighters, tied up where the boats of Pizarro and Cortez were made fast, unloading crates of American automobiles, American canned foods and potatoes, Scandinavian lumber, and taking on cargoes of sugar and bananas. Inside the gate, to the right and dominating it on a small hill, are the ruins of the Casa de Diego Colon. The residence of the son of Christopher Columbus, or Cristobal Colon, was built by him in 1510, and it was to this palace that he brought his bride, Maria de Toledo, cousin of King Ferdinand of Aragon. From this building he governed the Spanish colonies; it was occupied by his family for several generations, and here Don Bartolome Colon, the founder of the city, died. The illustration of the ruins on page 542 shows something of the character of the masonry. The walls, over 2 feet thick, are of the local coarse, brown-gray coral rock, pieced out here and there with long Roman brick. The plan is H-shaped, and the fragments of the arcades closing the ends of the H are still clearly discernible. The windows are mostly elliptical, and some of them still retain their Gothic cusps. The mouldings are crude and probably, like the walls of the building, were coated over with stucco. The finest bit of detail still existing is the entrance from the land elevation, which was probably entered through the arcade.

From the gate of San Diego very narrow streets lead up into the city. The low buildings, one and two stories high, have occasionally an interesting motif, but for the most part are simple and massive. Iron grilles keep the general public from walking into the parlor, which is usually at the front and on the street level; behind this room is a second, and then an open patio, behind which is the kitchen with its earthen stove, burning charcoal. The door shown in the illustration on this page is that of the old Royal Mint which was the first building of its kind to be erected in this country. Such relics of the past as this should be preserved, and in the memorial competition program there is included a museum in which it is to be hoped that this old doorway may be saved from the encroachments of modern times. The door itself is painted pale blue; the ornament is whitewashed and stands out brilliantly against the Pompeian red walls. This bold use of color is one of the most striking things about Santo Domingo.

The door to the shop shown upon page 544 is surrounded by coral stucco and surmounted by a white

Doorway, Convent of Santa Clara

Entrance to a Private House

stucco lintel, at the ends of which are small brackets supported by cherub heads. The cornice is typical, built of brick with stucco mouldings "run over" them. As there is no frost, stucco is a fairly durable material. The severe entrance of the convent of Santa Clara, shown upon this page, was built during the early part of the fifteenth century, and in the pediment there is a fine polychrome effigy of Santa Clara holding a reliquary. Inside the doorway is a great and beautiful room whose solid mahogany rafters are supported on Gothic arches. Iron water spouts, which throw the rain over the narrow sidewalk, remind one that during the rainy season the heavens frequently open and pour forth a short-lived but mighty deluge. The similar doorway, shown upon this page still retains its original wooden door, which has never been painted, and which has now the soft dove color of old driftwood. The window grille beyond is very typical, with its moulded cornice and sill. Behind such grilles as this are wooden shutters (there are no glazed windows), which serve to keep out the heavy rains and the noonday sun. During the daily two-hour siesta, throughout the city, these blinds are closed, and the streets are deserted.

The ruins of the church and monastery of San Francisco are among the most imposing monuments of the city and contain interesting fragments of Gothic vaulting. The heavy masonry walls, sometimes 3 or 4 feet thick, are a reminder to present-day designers that this country is subject, fortunately not frequently, to earthquakes, and that structures must be built in the most substantial manner possible.

The chief center of interest to a visiting architect is the lovely old cathedral of Santo Domingo. Its construction was started in 1514, under the direction of an architect named Rodriguez, who came from Spain, and in 1540 the church was dedicated. The interior is chiefly Gothic in feeling, with a very wonderfully vaulted nave, but the exterior felt the influence of the Renaissance, as may be judged from the sketch of the west, or main, facade, an illustration of which is given in this issue of THE ARCHITECTURAL FORUM. It was to this old building that the bones of Christopher Columbus were removed from Havana, and today, according to very substantial evidence, they rest in the nave of the cathedral directly in front of the main entrance. The north side of the cathedral is shown upon page 537 and is typical of the peculiar type of design used throughout the city. It was erected probably by Indian laborers who did not understand just what was required of them. The color is the soft gray which all the local masonry assumes if left undisturbed. A visit to Santo Domingo gives an architect a closer insight into the lives of the earlier discoverers. It shows the type of building to which they were accustomed, and it furnishes inspiration to us today, to help solve our problems of construction in a happy manner.

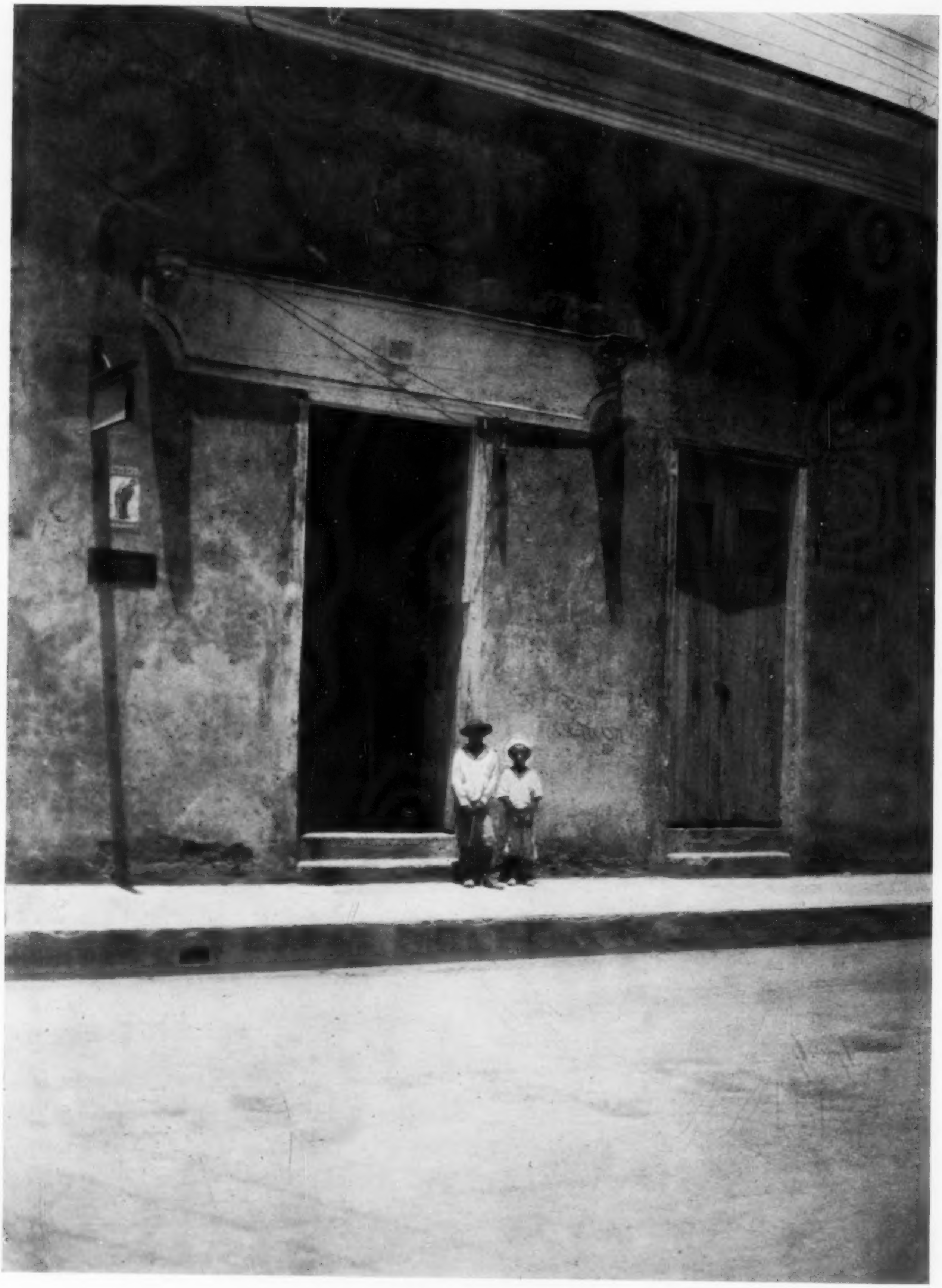
ENTRANCE TO THE FORT, SHOWING THE "HOMAGE TOWER," BUILT IN 1503

From a Litho-pencil Sketch by Edwin Laclede Howard

CATHEDRAL OF SANTO DOMINGO

CASA DIEGO COLON

SAN DIEGO GATE

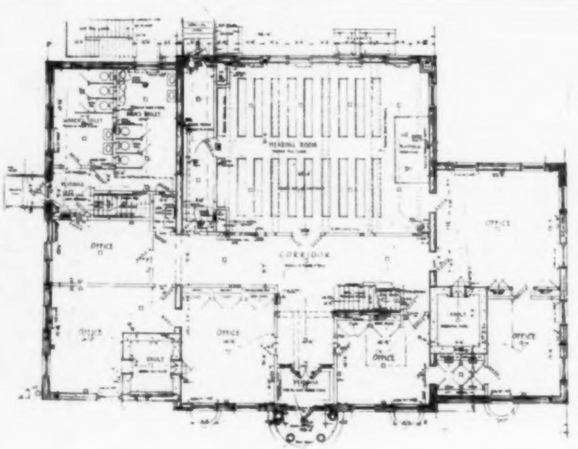


A SHOP DOOR

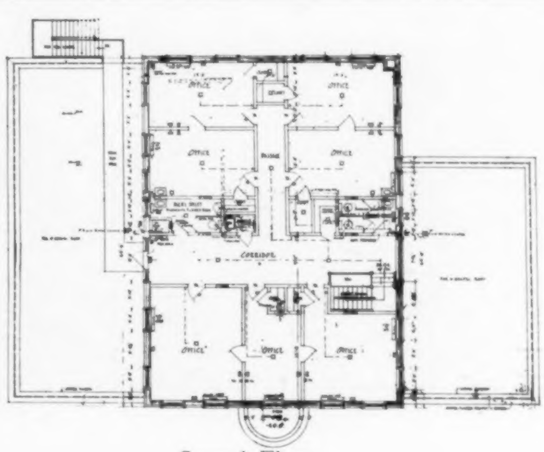
Photos. Frances Benjamin Johnston

TOWN OFFICE BUILDING, HYANNIS, MASS.
J. WILLIAMS BEAL, SONS, ARCHITECTS; L. FRANK PAINE, ASSOCIATE ARCHITECT

DURING the past few years there have been a great many excellent small public buildings erected in different parts of the country. Space does not permit us to publish in this section many of these small but interesting designs. We have, therefore, chosen a group of buildings differing greatly in character of design and point of location. The first of these small buildings is the new town building at Hyannis, Mass. This is a simple Colonial structure, comprising a two-story central building balanced on either side by a one-story wing. A classic cornice with brick parapet above emphasizes the top of the main building, while simpler cornices and parapets crown the two low wings. Arched windows and a semi-circular porch of rather heavy classical design emphasize the main story and entrance to the building. On the first floor is a large hearing room or town hall. Suites of offices occupy the rest of the first floor. A stairway at one side of the entrance hall leads to a second story, where seven smaller offices are located. This second floor is so planned that the one-story wings may be built up another story and connected with it by means of doorways at either end of the center corridor. The style of architecture chosen for this building is more English Georgian in its character than Colonial, but this style is what the Colonial was derived from, and its use is quite consistent with architectural propriety.



First Floor



Second Floor

COST AND CONSTRUCTION DATA

Town Office Building, Hyannis, Mass.

J. Williams Beal, Sons, Architects; L. Frank Paine, Associate Architect

DATE OF COMPLETION: July, 1927.

GENERAL TYPE OF CONSTRUCTION: Concrete foundations; exterior walls, brick with tile backing; first floor concrete, second floor and roof, wood framing; steel stairs.

EXTERIOR MATERIALS: Waterstruck brick with wood trim.

ROOF: Tar and gravel, with copper flashing.

FLOORS: First floor, terrazzo, rubber tile and linoleum; second floor, hard pine.

HEATING: Vapor system. Magazine feed boiler, burning buckwheat coal. Direct radiation throughout, with indirect heater for fresh air supply to hall.

INTERIOR WOODWORK: Birch and whitewood.

INTERIOR WALL FINISH: Plaster.

INTERIOR DECORATIVE TREATMENT: Plain painting.

APPROXIMATE CUBIC FOOTAGE: 156,500.

COMPLETED COST PER CUBIC FOOT: 51 cents.

TOTAL COST: $79,336.49.

Main Entrance

Town Office Building, Hyannis, Mass.

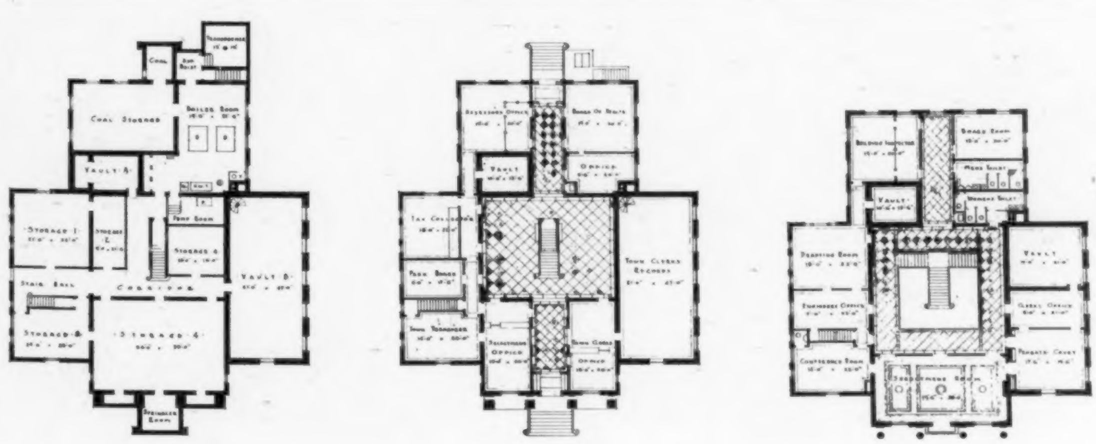
J. Williams Beal, Sons, Architects; L. Frank Paine, Associate Architect

Photos. Frances Benjamin Johnston

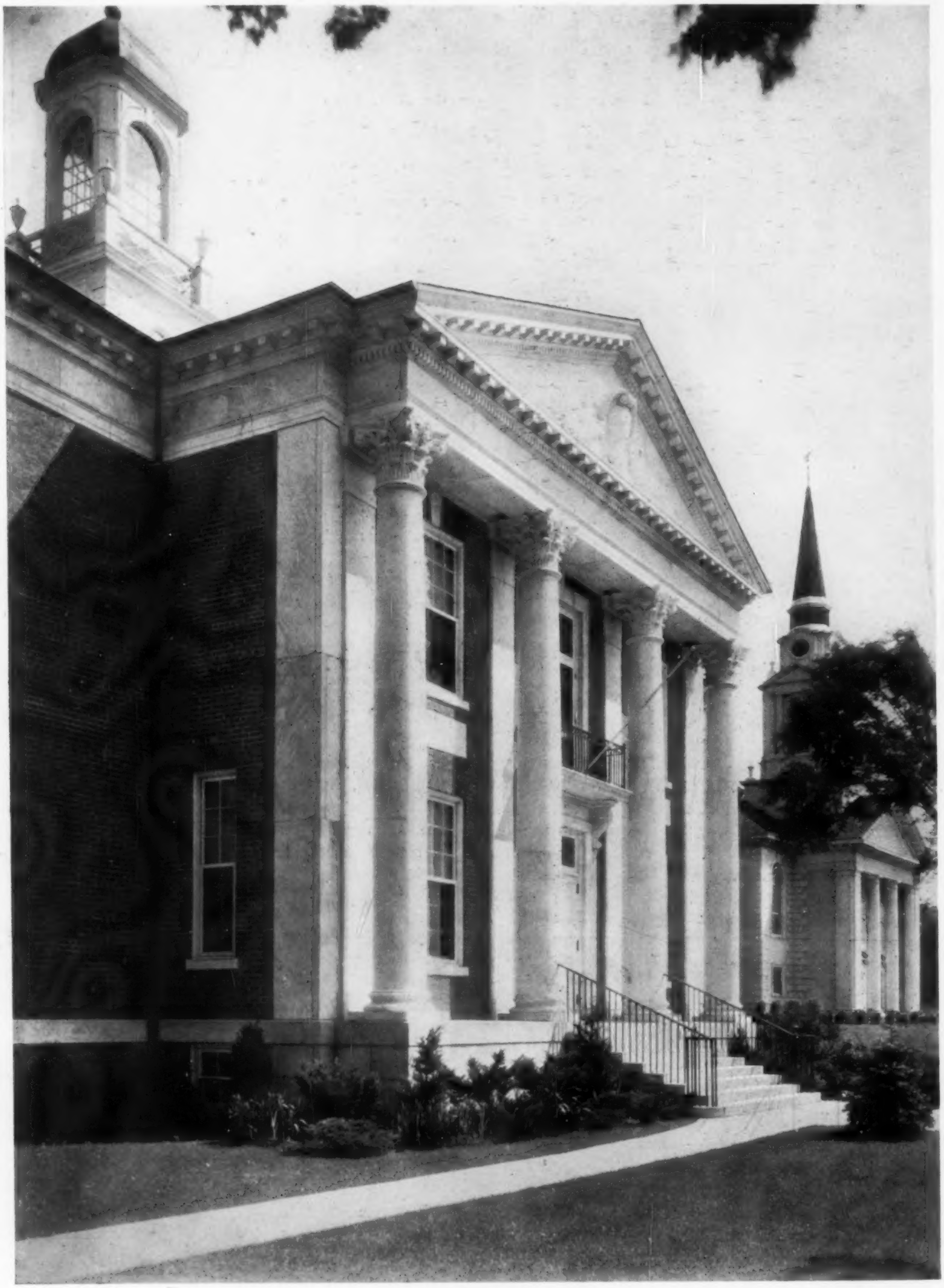
ADMINISTRATION BUILDING, MANCHESTER, CONN.

FRANK C. FARLEY AND WILLIAM HARMON BEERS, ASSOCIATED, ARCHITECTS

HERE is a building thoroughly monumental and consistent with its location and purpose. Located in one of Connecticut's oldest and most aristocratic communities, dignity and distinction are secured through the sizes of the windows, the heights of the walls, the restrained and refined Colonial details of the entrance portico, with its rich entablature and pediment executed in white marble, and the tall, graceful, well proportioned cupola. The location of this town hall on the ridge or plateau which dominates the town is particularly fortunate. Together with the fine Colonial church just beyond, a most harmonious group is formed, almost giving the semblance of a town center. The similarity in scale



Basement First Floor Second Floor



ENTRANCE PORTICO

ADMINISTRATION BUILDING, MANCHESTER, CONN.

FRANK C. FARLEY AND WILLIAM HARMON BEERS, ASSOCIATED, ARCHITECTS

ENTRANCE DETAIL

ADMINISTRATION BUILDING, MANCHESTER, CONN.

FRANK C. FARLEY AND WILLIAM HARMON BEERS, ASSOCIATED, ARCHITECTS

COST AND CONSTRUCTION DATA

Administration Building, Manchester, Conn.

Frank C. Farley and William Harmon Beers, Associated, Architects

YEAR OF COMPLETION: 1927.

GENERAL TYPE OF CONSTRUCTION: Basement walls, concrete; first and second story walls, hollow tile brick veneer; vault walls, solid brick; floor construction, hollow tile and reinforced concrete.

EXTERIOR MATERIALS: Selected common brick.

ROOF: Mottled green and purple slate laid on 2-inch plank supported on steel framing.

FLOORS: Finished floors in halls and corridors, terrazzo; offices, linoleum.

HEATING: Vapor vacuum system; provision made for heating former Hall of Records, located across the street.

ELECTRICAL EQUIPMENT: Circulating pump for heating system.

INTERIOR WOODWORK: White pine; doors, birch.

INTERIOR WALL FINISH: Painted plaster.

INTERIOR DECORATIVE TREATMENT: Walls buff; trim and ceilings, white enamel.

APPROXIMATE CUBIC FOOTAGE: 294,000.

COMPLETED COST PER CUBIC FOOT: 57½ cents.

TOTAL COST: $169.270.

and character of the detail of the town hall and the church is fortunate and pleasing. An even more monumental character is secured in the former by the use of the Corinthian order contrasting well with the Tuscan order used in the church beyond. The first floor of the building is sufficiently high above the grade to permit the locating of numerous storage rooms and vaults on the basement floor. As the building is of fireproof construction throughout, these basement rooms can safely be used for the storage of valuable documents and records. The plan is practical, well balanced and convenient. On the first floor are located the various offices of the town officials, grouped around a center hall, which has a monumental stairway and balcony above railed with interesting ironwork. At the front of the second floor is a spacious room for the use of the selectmen. No auditorium was included in this town structure, because the high school building not far away has an auditorium of sufficient size to accommodate large town gatherings. The interior detail is all of Colonial character appropriate to the exterior design of the building. White painted woodwork, deep toned walls and mahogany doors carry out the public character.

Stair Hall

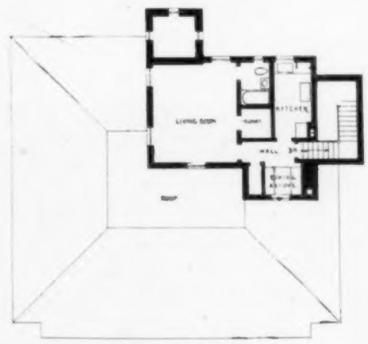
Entrance Lobby

Administration Building, Manchester, Conn.

Frank C. Farley and William Harmon Beers, Associated, Architects

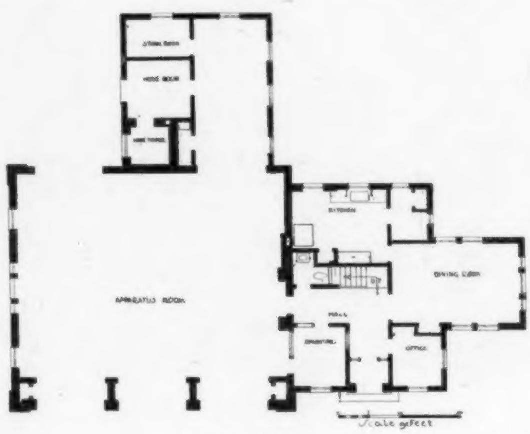
Photos. F. E. Geisler

FIRE HOUSE, PALM BEACH
CLARK J. LAWRENCE, ARCHITECT



Roof

THE Spanish style has been consistently and attractively used in the design of this fire house at Palm Beach. It is always gratifying to see an experiment in architectural design successfully carried out. The irregular plan and grouping of the different parts of this design are interesting. The apparatus room, which is the chief part of any fire house, is the chief feature. Three large doorways designed in the manner of an open arcade are surmounted by a long covered gallery, onto which open the dormitory and recreation room on the second floor. A locker room and lavatory occupy the rear of the second floor. On the third floor, combining in one group with the tower of the building, are living room, bathroom, kitchen and dining alcove. These are intended for the use of the fire lieutenant in charge



First Floor

Second Floor

COST AND CONSTRUCTION DATA

Fire House, Palm Beach

Clark J. Lawrence, Architect

YEAR OF COMPLETION: 1927.

GENERAL TYPE OF CONSTRUCTION: Semi-fireproof.

EXTERIOR MATERIALS: Stucco.

ROOF: Spanish tile.

APPROXIMATE CUBIC FOOTAGE: 95,000.

COMPLETED COST PER CUBIC FOOT: 50 cents.

TOTAL COST: $40,000.

of this station, as the main dining room for the firemen, together with a large kitchen and pantry, and the operator's and chief's offices are located in a one-story wing adjoining the apparatus room. The informal plan of the building gives an opportunity for an exterior more picturesque and attractive than is usually possible in the design of a fire house. The structure as a whole composes well and convinces one of the appropriateness and desirability of using so definite a style as the Spanish for the design of a purely utilitarian and municipal building in a Florida town. The tinted stucco walls, the Spanish tile roof and the stone door trim further add to the distinctive character of the building. The residential character of its appearance is due partly to the spacious overhanging gallery across the front. This aids in taking away the "public building" aspect so common to structures of this nature and helps it to fit pleasantly into its surroundings, which are those of a high class residential district. At the same time, the utility of the layout is not interfered with in any way; the tower which adds so much to the appearance of the exterior is utilized for the drying of hose, and the screened-in porch is greatly appreciated by the firemen as a lounging and sleeping place. The entire effect of the fire house is derived from a study of mass and the building up of an interesting silhouette. There is no elaborate or expensive detail, and yet it is not lacking in interest and charm which tie it well into its setting.

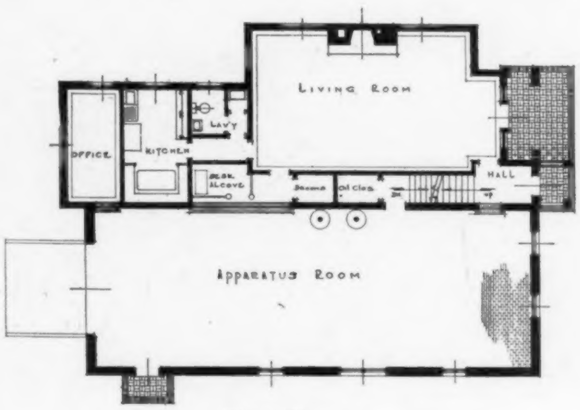
Side Entrance

Fire House, Palm Beach

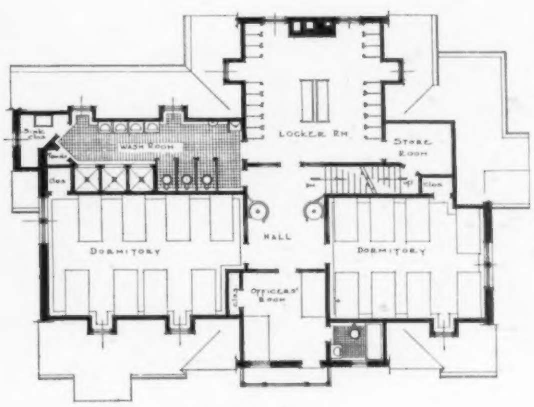
Clark J. Lawrence, Architect

FIRE STATION, WHITE PLAINS, N. Y.
THEODORE RICHARDS, ARCHITECT

THIS two-apparatus fire building may logically be called a fire house. The character of its design distinctly marks it as a house and not as a typical fire station with several large doors and two or three stories of brick walls. The building is not only well designed but is well located at the corner of two streets in a suburban section of the important New York county seat of White Plains. The fact that a fire house is occupied for the greater part of the day as a place of residence makes it additionally appropriate, that the building should be designed as a house and not as a large stable or garage. The several gables, the long, sloping, deeply pitched roof and the tinted stucco walls are all features which add to the domestic quality of the design. The roof is high and its pitch sufficiently steep to permit excellent head room for the two large dormitories, locker room, wash room and officer's bedroom on the sec-



First Floor

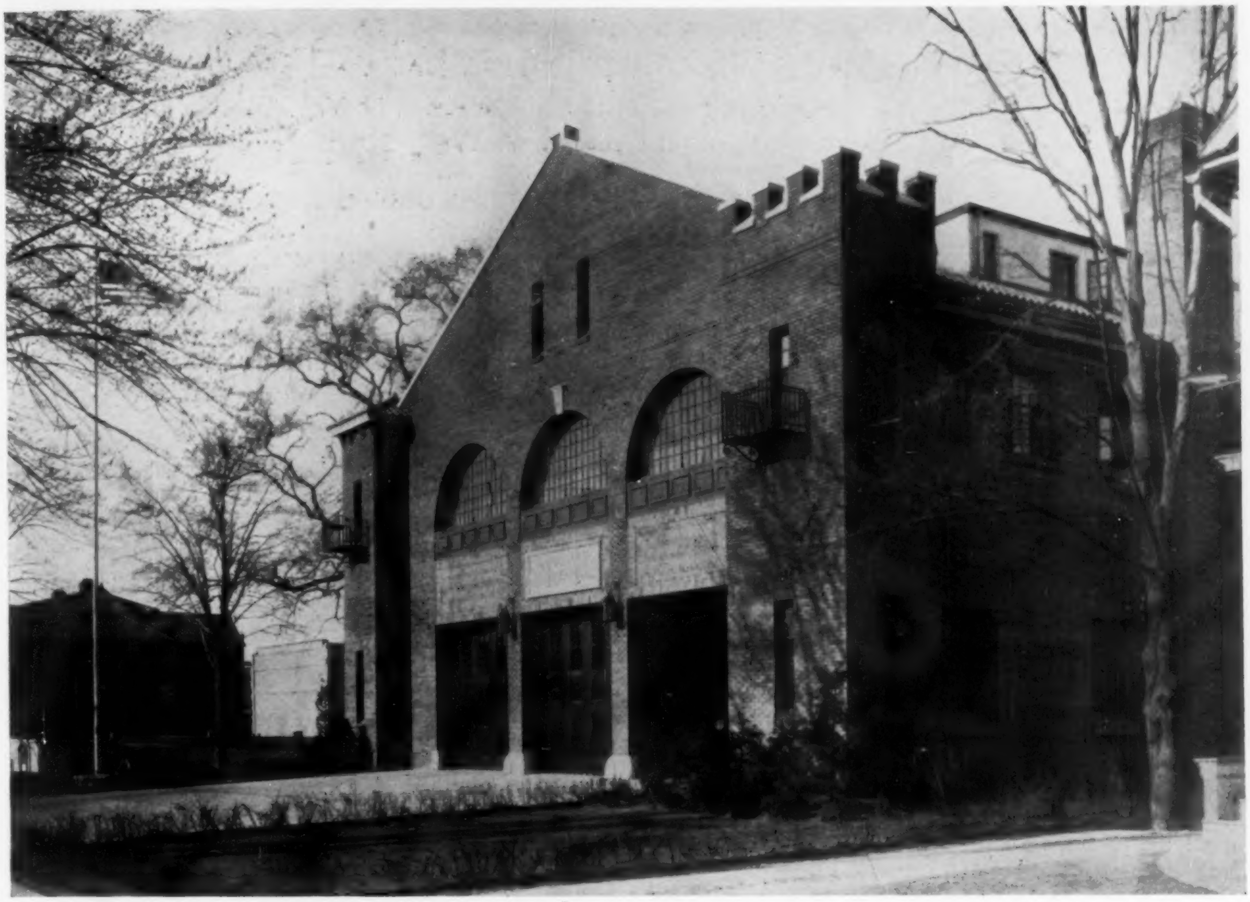


Second Floor

ond floor. The proverbial brass pole as well as a stairway connects this floor with the floor below, where there is located a deep apparatus room sufficiently large to take two pieces of apparatus, one behind the other. Parallel with this long, deep room is an office for the fire captain or lieutenant, and a large living room, kitchen and lavatory. As no separate dining room is provided, it is evident that the living room is used also for dining.

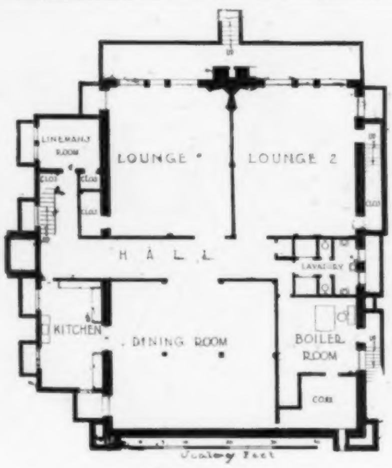
Compared with the typical fire engine house of 25 and 30 years ago, the design and plan of this building mark a great step in advance. The building is convenient, spacious and sensibly planned. Rooms for all of the various requirements of the fire fighters' residence are here, provided in suitable locations. The architect has succeeded in obtaining not only a home-like but a picturesque quality in this design. In comparison with some of the uninteresting neighboring small houses, it is indeed in pleasing contrast. As no tower is provided in this building,—a tower in which long lengths of hose may be hung up for drying after use,—this design is suitable for a fire house where only a motor chemical wagon and hook and ladder are stationed, which is often the case.

Fire Station, White Plains, N. Y.
Theodore Richards, Architect



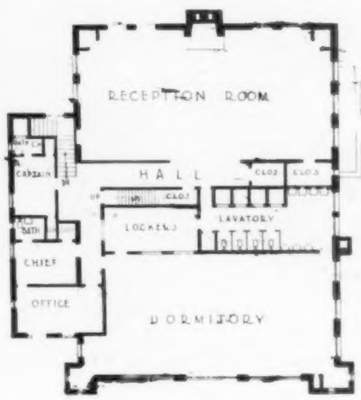
FIRE DEPARTMENT HEADQUARTERS, WHITE PLAINS, N. Y.
RANDELL HENDERSON, ARCHITECT

HERE is a design for a fire department building following more closely the style of design in favor 30 years ago. In general mass the design is good. The emphasis laid on the three large entrance doors is well carried out by the tall arches, in the lower parts of which these deep openings are located. The rather thin towers or bays at either corner at the front of the building, one of which has a castellated top reminiscent of the wooden Gothic architecture of the Victorian period, do not add to the dignity of an otherwise satisfactory design. In fact these corner towers give to the building a suggestion of the type of design frequently used for state armory buildings several decades ago. The structure would have been simpler and more dignified, and greater emphasis would have been placed on the triple arches which form the principal motif of the entrance elevation of the building, had these corner towers been entirely omitted. The use of Spanish tile in preference to slate or a flat tile also seems in-



Basement

First Floor



Second Floor

COST AND CONSTRUCTION DATA

Fire Department Headquarters, White Plains, N. Y.

Randell Henderson, Architect

DATE OF COMPLETION: August, 1927.

GENERAL TYPE OF CONSTRUCTION: Entirely fireproof.

EXTERIOR MATERIALS: Black face brick; terra cotta trimmings.

ROOF: Spanish tile.

FLOORS: Composition; apparatus room, brick.

HEATING: Vapor system.

INTERIOR WOODWORK: Birch veneer doors; no wood trim.

INTERIOR WALL FINISH: Public halls and bathrooms tiled; apparatus room, glazed brick; remainder, ornamental plaster.

INTERIOR DECORATIVE TREATMENT: Ornamental plaster glazed. All fireplaces of tile.

APPROXIMATE CUBIC FOOTAGE: 396,800.

TOTAL COST: $150,000.

consistent with the style and character of the building. The general proportions and the plan of the building are good. The apparatus room is sufficiently large to take four pieces of fire apparatus. Office, rest and work rooms are located in a wing at one side of this apparatus room. The fact that this latter room is only one story high gives a tremendous amount of floor space above. Although the building does not seem to be located sufficiently high above grade to permit of a well lighted basement, the principal living quarters for the firemen resident in this building, such as the two large lounges with corner fireplaces, a large dining room and kitchen, are located in the basement, where the windows are lighted by means of large areas. Such an arrangement is, of course, an economy in the cost of the building, as otherwise it would have been necessary to place these principal living rooms on the third floor, as it is always essential that dormitories and sleeping quarters of the firemen shall be not more than one story above the apparatus room and always connected by the typical brass fire pole, down which the firemen slide in their speedy preparation to get out the apparatus and be off in answer to the insistent call of fire.

Fire Department Headquarters, White Plains, N. Y.
Randell Henderson, Architect

FIRE HOUSE, WESTON, MASS.
ALEXANDER S. JENNEY, ARCHITECT

THIS is a good example of the use of the Colonial style of architecture for a semi-monumental public building. As has already been said in connection with one of the other fire houses shown in this group, it is consistent and logical to give a somewhat domestic quality to buildings designed for this purpose. The town of Weston, Mass., contains many fine old examples of Colonial architecture. So the architect in designing this fire house showed good judgment in the selection of style. The well proportioned dormer windows and the gambrel roof with large end chimneys are characteristic of the style. The use of exterior stone capped piers at each corner of the main building is an interesting variation which undoubtedly serves some structural purpose. The steep drop in the grade of the lot on which the building stands makes it possible to have a high basement and small garage under the building at the rear, where special interest is added to the elevation by the introduction of a well proportioned, low, square tower surmounted by a balustrade and cupola reminiscent of Colonial work in Newburyport and Portsmouth. As the cupola is enclosed, there seems to be no provision for an outside fire bell on this building. Whether the pipe projecting from the roof of this cupola is used as a fire whistle or for ventilation purposes, cannot be determined.

Three large doors on the front emphasize the building's purpose. At the right of these doors is a platform supported by concrete retaining walls onto which opens a side door leading out of the large apparatus room, which apparently occupies the entire first floor. From the number of windows on the second story it is obvious that the dormitory and living rooms are located there. From the location of three second-story windows at the west end of the building it would seem that the chimney which rises directly above the middle window must be broken around it and carried down grade in two sections; or else this is a dummy chimney put up to balance that at the opposite end of the roof. The brickwork of the entire building shows unusual care in laying, and the use of recessed brick arches at the three large entrance doors, gives a suggestion of English rather than American design. This is also true of the main cornice of the building, which is entirely carried out in brick. The only wooden trim on the building requiring occasional attention in the way of repairs and painting is the cupola, and the trim on the dormer windows and under the roof's overhang.

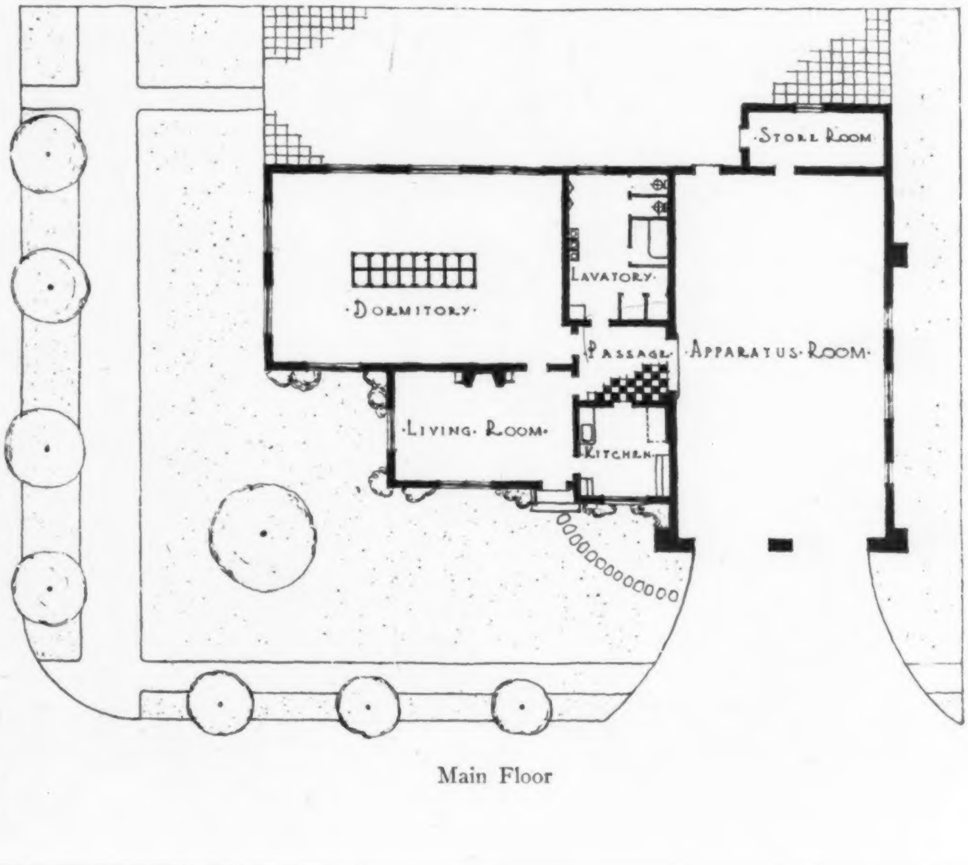
This is a successful piece of architectural design. The elevations clearly indicate the character and purpose of the building. Although a definite style of architecture has been used as the inspiration for the design, there has been a certain amount of freedom shown in the handling of the style.

FIRE HOUSE, WESTON, MASS.
ALEXANDER S. JENNEY, ARCHITECT

Photo. McCurry

FIRE HOUSE, SACRAMENTO
DEAN & DEAN, ARCHITECTS

HERE is another interesting example of the use of the "Mediterranean" type of architecture for the design of a fire house. The character and plan of the building are plainly indicated in the exterior elevation. The main apparatus room is made the chief element of the design, with its two large arched doorways and low tiled roof, which give the effect of an old farm barn in southern Italy. The design of the chimneys, and the low, one-story rooms which abut the higher dormitory wing of the building are suggestive of the sunny South. The plan is simple and compact. The large, deep apparatus room is of sufficient size for two pieces of fire apparatus. A paved passage leads from this room into the living portion of the building, where there are a dormitory, lavatory, living room and kitchen.

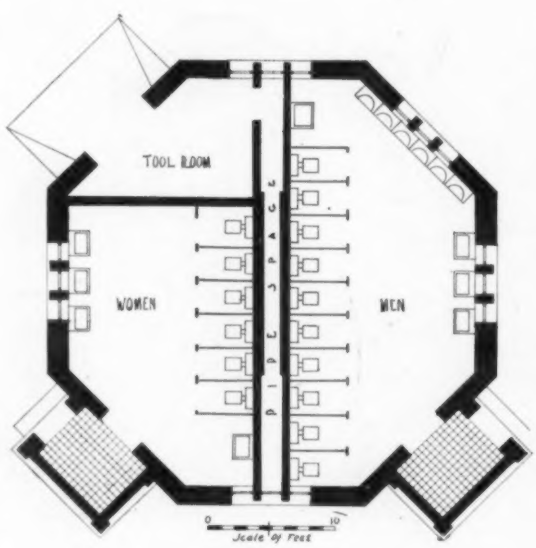


Main Floor

Photos. M. W. Reeves

COMFORT STATION, ST. PETERSBURG, FLA.
HENRY L. TAYLOR, ARCHITECT

THIS building is designed in the style known as "Lombard Romanesque," which is one of the most interesting in Italian architecture. Although one of the lesser important types of municipal buildings, the excellence of this design proves that even such buildings as comfort stations can be made to have architectural interest and merit. Characteristic of the style, most of the detail, such as the main cornice and frieze, some of the wall panels and the base course, is carried out in brick. In this type of design it is thoroughly consistent and appropriate, as well as pleasing to the eye, to use the typical corrugated Spanish tile. Any type of flat tile would have made the building much less interesting and consistent. The octagonal plan is simple, well balanced and direct. A narrow passageway, in which all of the pipes from the various toilets are located, extends through the center of the building. This pipe passage is accessible from the small tool room at the rear. On one side of this passage is the men's room, and on the other the women's room. These rooms are reached from separate entrances, each of which has a small vestibule, as seen in the accompanying illustration. Some sort of vestibule or entryway is always essential in the plan of a comfort station. Frequently these vestibules are placed inside instead of outside the building. In this case there was no room on the inside, so the architect very wisely designed small exterior vestibules, which add to rather than detract from the exterior interest of the station.



Main Floor

Men's Entrance

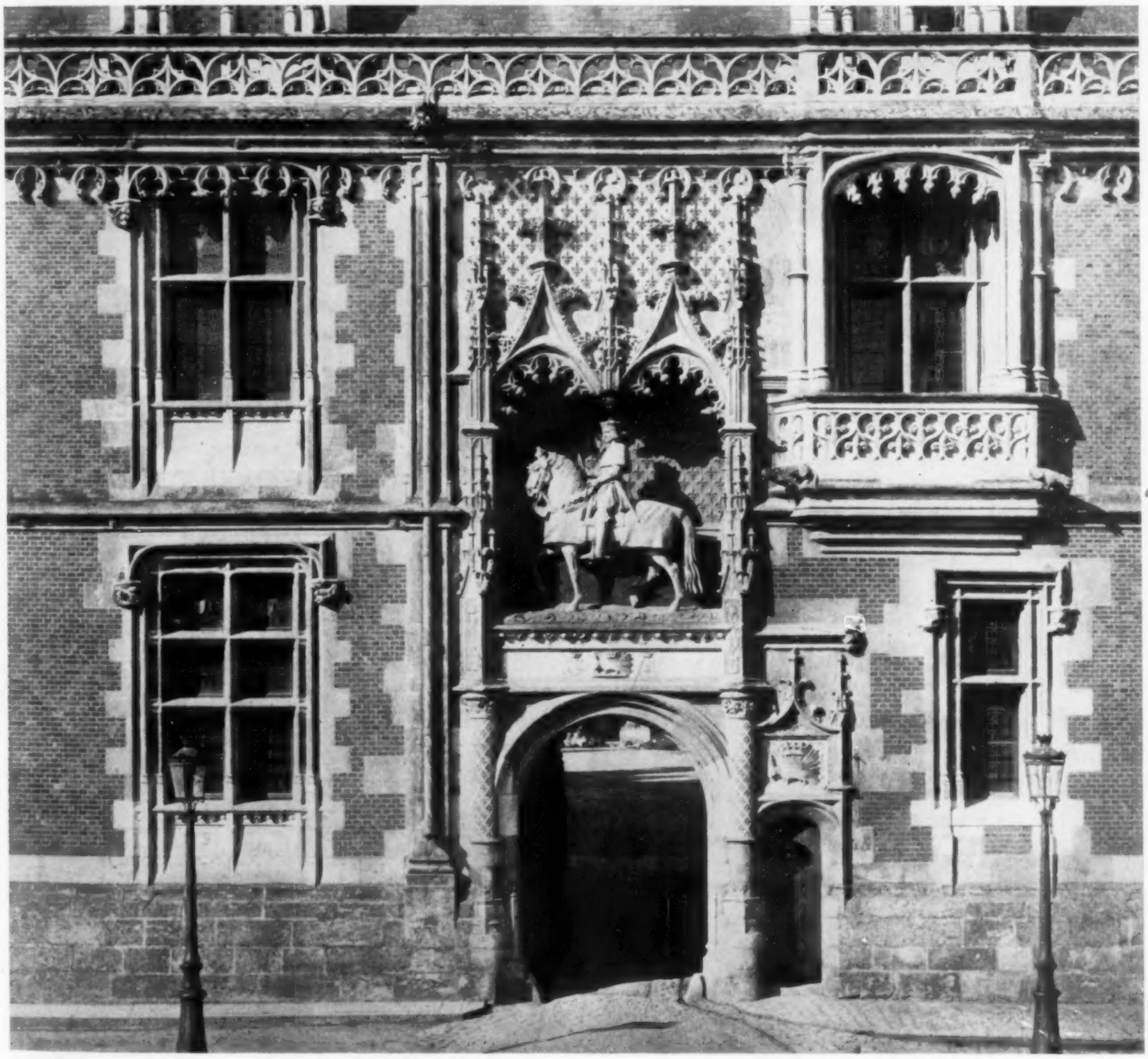
INTERIOR ARCHITECTURE

DETAILS FROM THE FRENCH CHATEAUX

TEXT AND MEASURED DRAWINGS BY
ALBERT A. CHADWICK

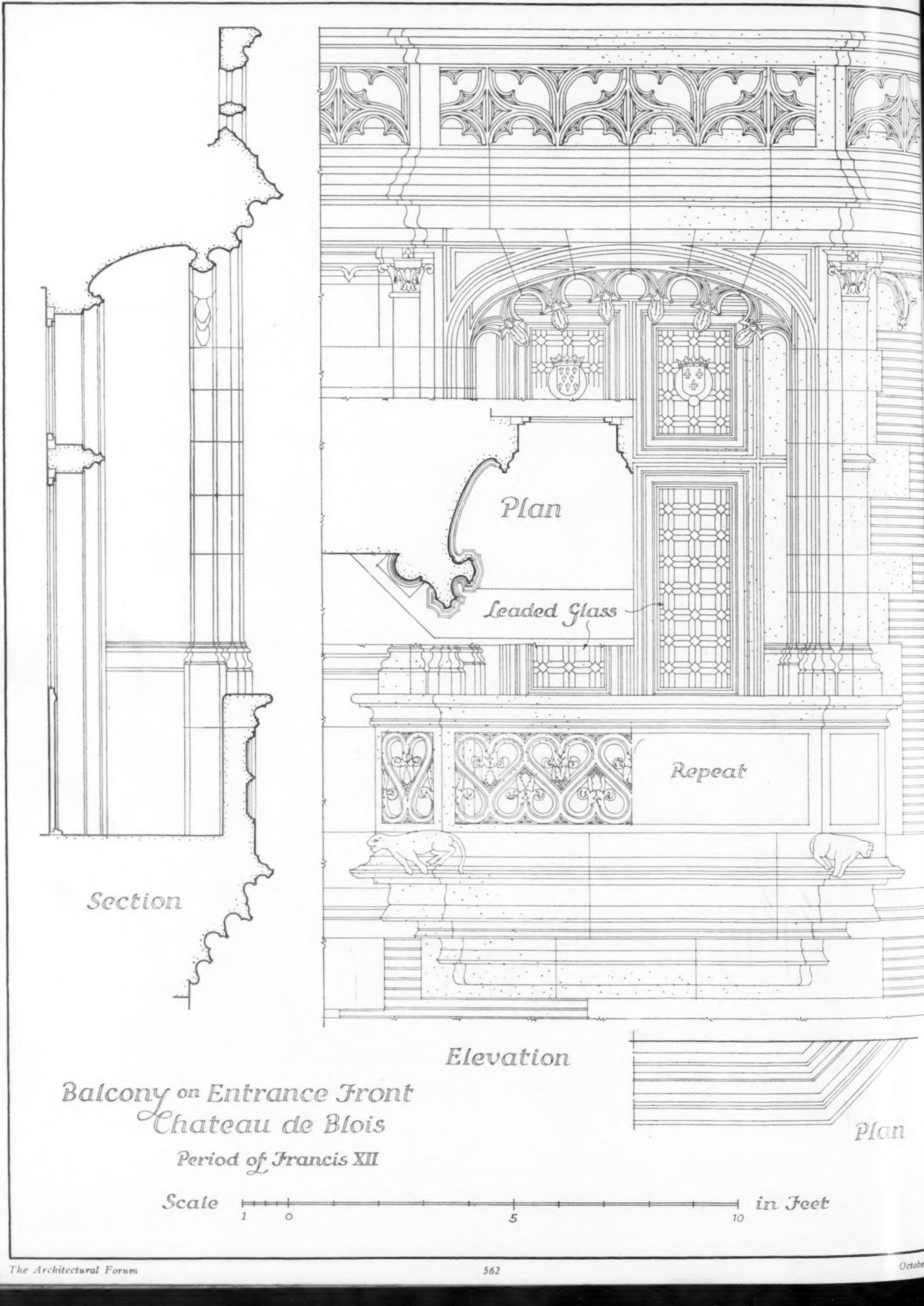
THE Louis XII wing at Blois is one of the few great buildings in France in which brick and stone are combined. The beautiful mellow red of its brickwork is a relief after the monotony of drab stone. At Blois we find motifs from the Louis XII wing, which is almost purely Gothic, constantly repeated in a modified form in the Renaissance wing of Francis I. This is not surprising, since there was practically no break in time between the completion of one wing and the beginning of the other, and it is also true that the same men carried on the work. The two balconies on the entrance front of the Louis XII wing with their fleur-de-lis ornamentation are very beautiful and unusual. They serve to give balance to a facade which would otherwise be rather uninteresting. The balconies on the north front, although they are flush with the face of the building and although their detail is entirely different, were evidently inspired by the two balconies on the entrance facade. However, this north front is not as pleasing in its design as is that of the wing of Louis XII, because the balconies are here rather monotonously repeated, detracting from their interest.

Many of the Renaissance cornices in France show that their inspiration was derived from the unique cornices at Blois. The cornice of the stair tower

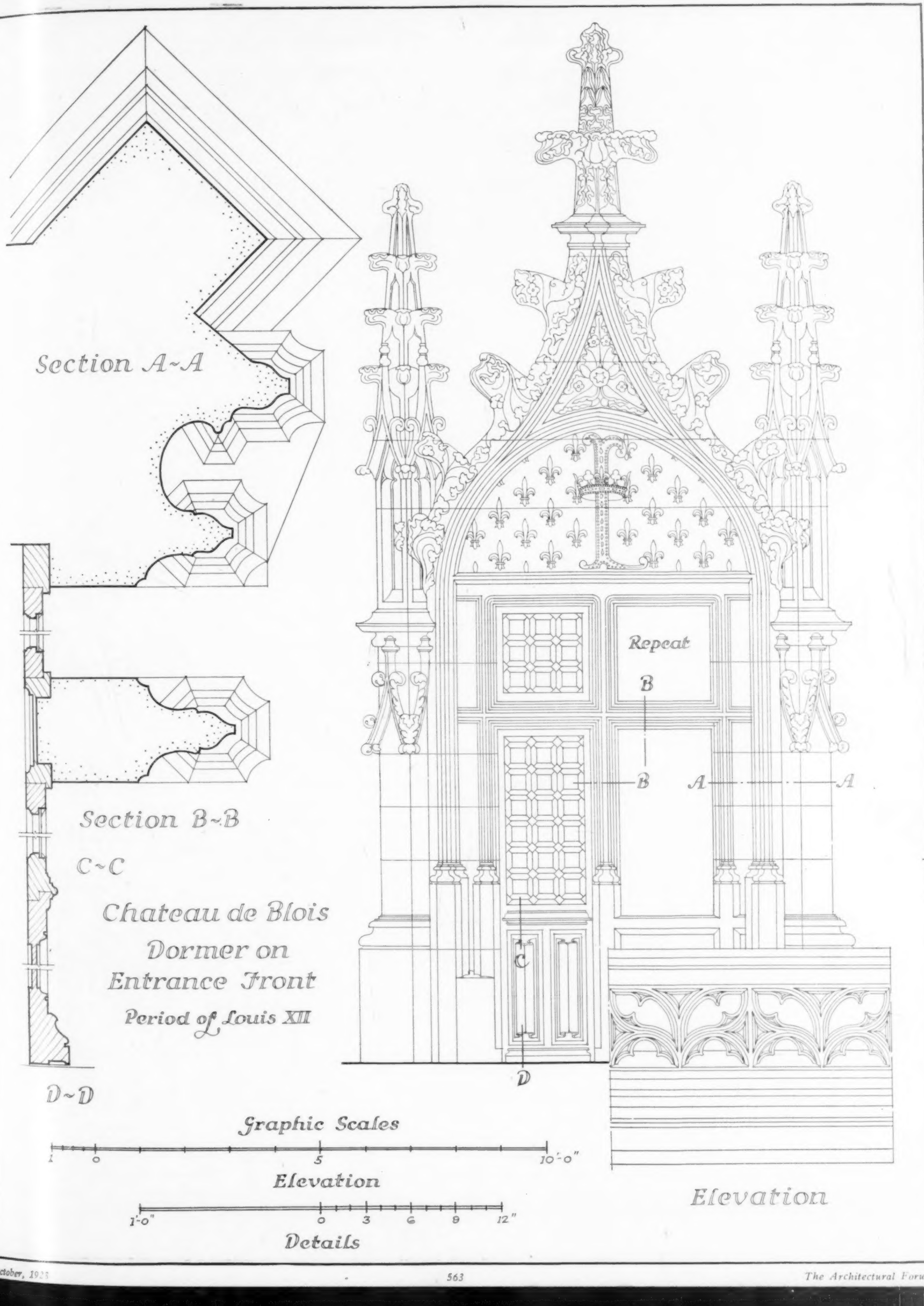


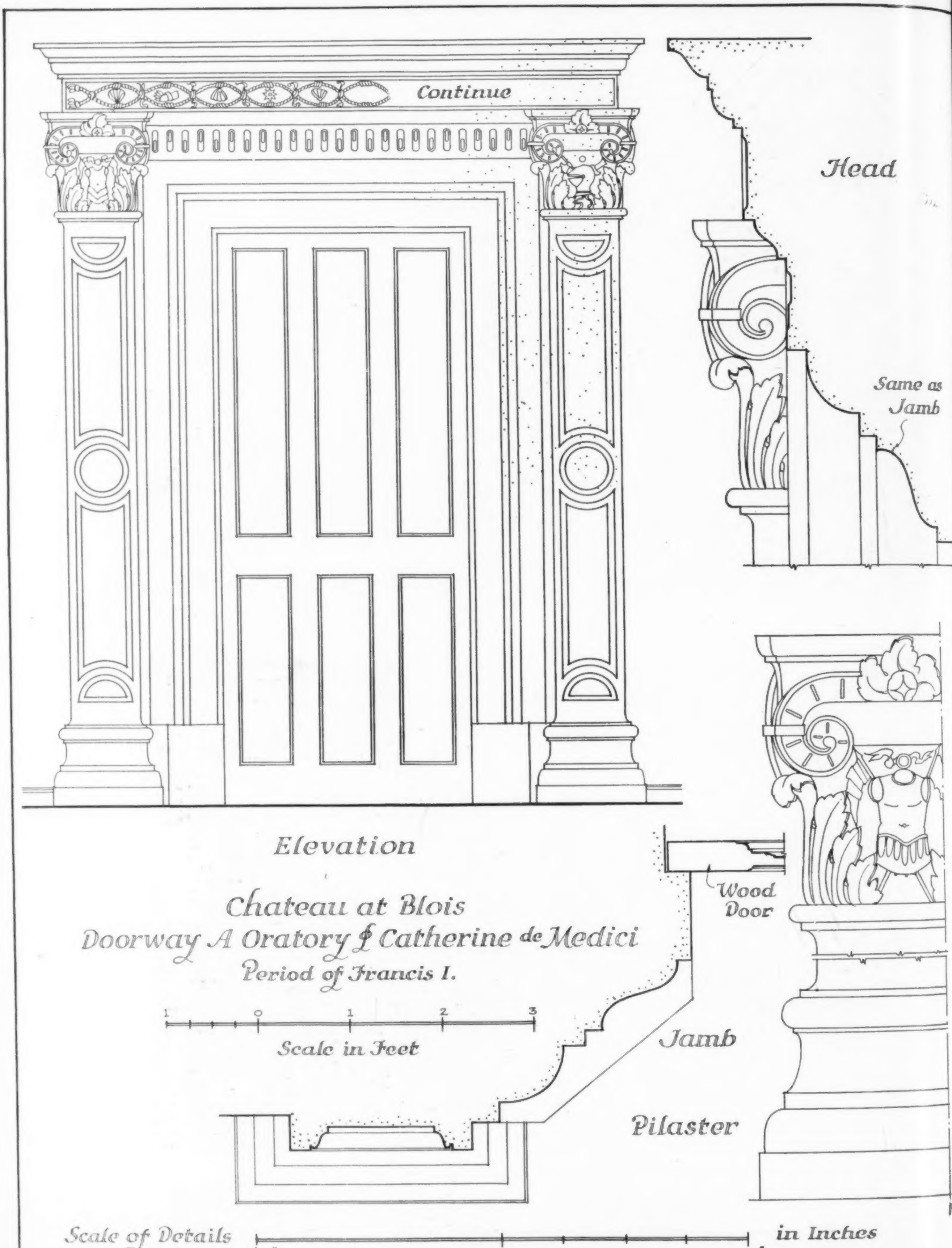
Detail of Balcony on Back

Entrance Front, Chateau de Blois



Balcony on Entrance Front
Chateau de Blois
Period of Francis XII


Section A~A
Section B~B
C~C
Chateau de Blois
Dormer on
Entrance Front
Period of Louis XII
D~D
Repeat
B
B
A
A
C
D
Graphic Scales
1 0 5 10'-0"
Elevation
1'-0" 0 3 6 9 12"
Details
Elevation

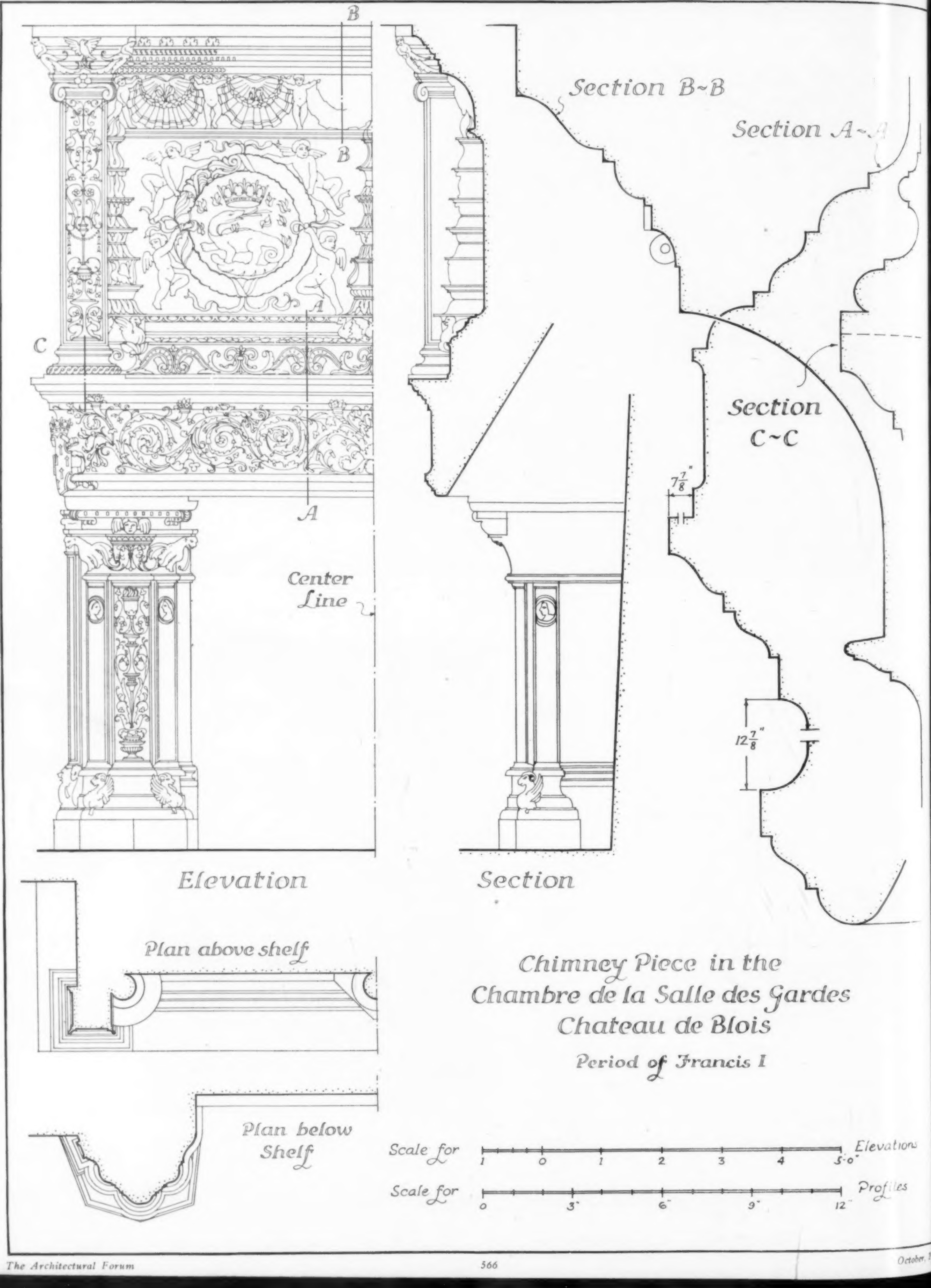


Continue
Head
Same as Jamb
Elevation
Chateau at Blois
Doorway A Oratory ₤ Catherine de Medici
Period of Francis I.
1 0 1 2 3
Scale in Feet
Wood Door
Jamb
Pilaster
Scale of Details
1'-0" 0 3 6 9 12"
in Inches

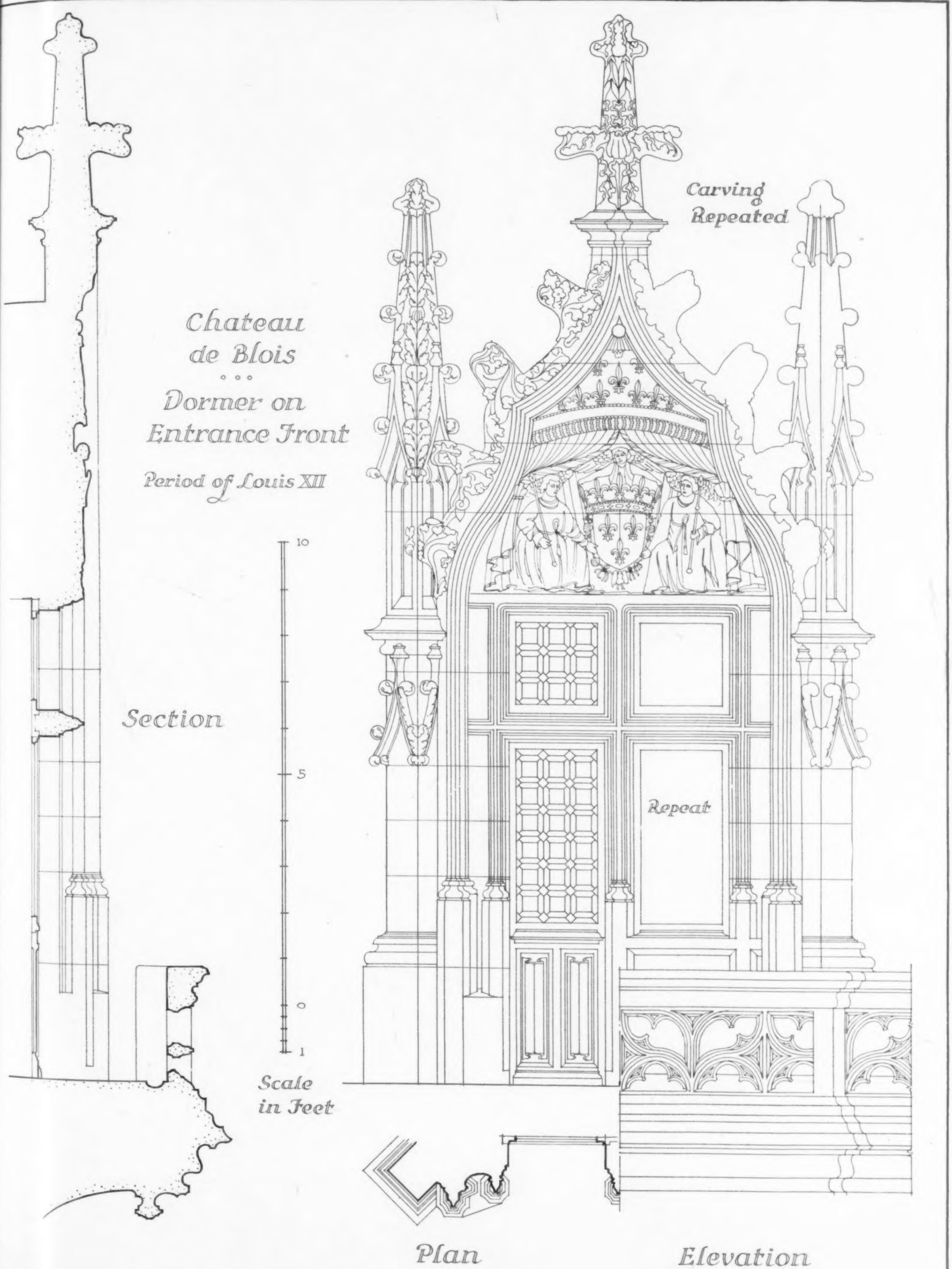
Chateau de Chenonceaux

in the Louis XII wing served especially as a prototype to be copied and repeated again and again. The cornice under the balcony in the court at Chaumont seems to represent the intermediate phase, while the cornice of the Francis I wing at Blois is the ultimate achievement. At Chenonceaux we find a regular entablature with architrave, frieze and cornice; but here ends any adherence to Italian precedent. The architrave has rather clumsy Gothic pendants located under the balusters of the frieze, while in the frieze itself is repeated the balustrade design of the lower balconies. The cornice, which has modillions with Gothic rosettes between them, was built at the same time as the Francis I wing of Blois, but the cornice of the latter was very much influenced by the earlier Louis XII, wing while that at Chenonceaux suggests much more the Italian precedent. The character of the work is cruder than that at Blois and nowhere nearly as effective. The chimneypiece in the *Chambre de Salle de Gardes,* which is one of the most beautiful of all the Renaissance fireplaces in France, was inspired by a chimney in the Louis XII wing. It is almost pure Gothic, and unusually rich and refined in ornament. The frieze below the shelf, with its foliated scroll, is especially beautiful. One cannot but marvel at the delicacy of carving and the beauty of line achieved by these old workmen, especially when one notes their lack of precision, which perhaps adds much to their charm and character.

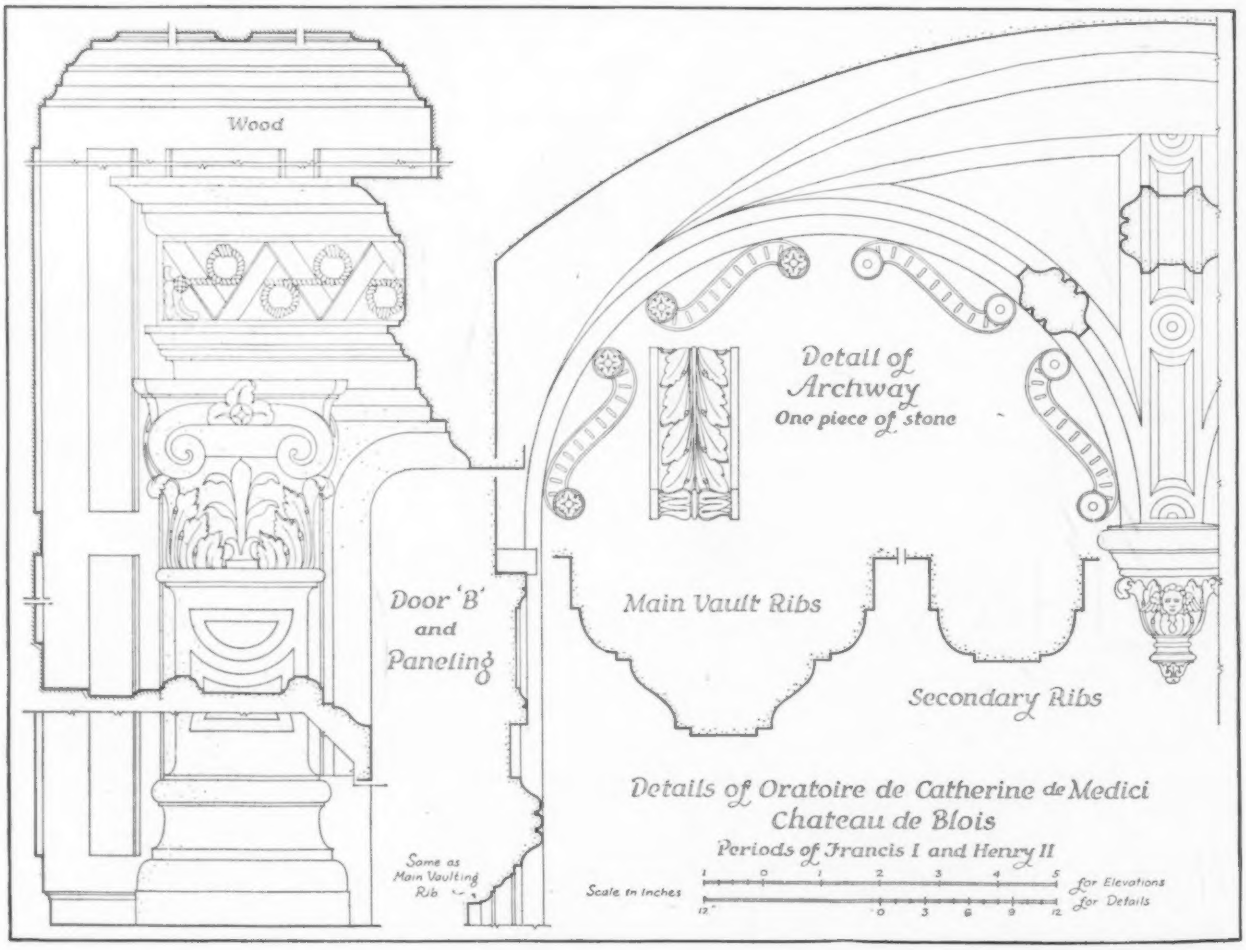
Chimneypiece, Chateau de Blois

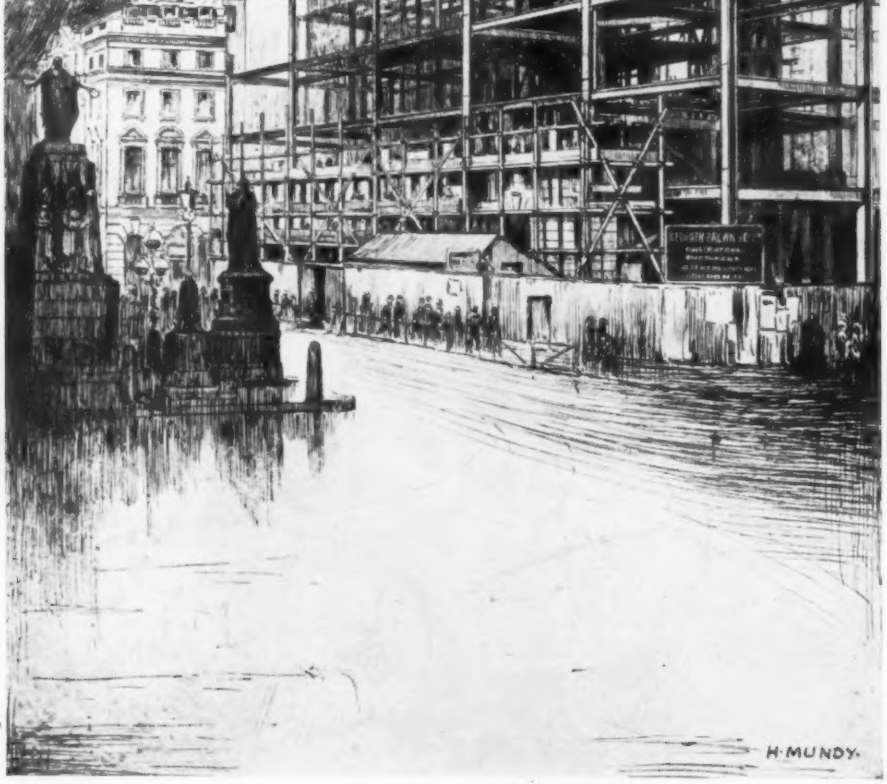


Chimney Piece in the
Chambre de la Salle des Gardes
Chateau de Blois
Period of Francis I


Chateau de Blois
Dormer on Entrance Front
Period of Louis XII
Section
Scale in Feet
10
5
0
1
Carving Repeated
Repeat
Plan
Elevation

Oratory of Catherine de Medici, Chateau de Blois





CONSTRUCTION IN LONDON
From a Pen Drawing by Harold Mundy

THE
ARCHITECTURAL
FORUM

VOLUME XLIX NUMBER FOUR

OCTOBER 1928

THE PROTECTION AND MAINTENANCE OF STRUCTURAL STEEL

BY
FRANK W. SKINNER
CONSULTING ENGINEER

UNDER ordinarily careful treatment, with reasonable conditions and requirements, the steel framework of a building can be relied on for strength and safety. At the same time, it conforms most readily to architectural æsthetic and economic requirements, occupies a minimum amount of space, permits maximum dimensions of construction, rapidity of erection, ease of repairs, and demolition or extension in service. Structural steel for architectural purposes must almost of necessity be designed in accordance with accepted rules and standards. It must conform to well perfected types and details, be entirely fabricated by skilled workmen with machine tools in special shops, and erected by experts with special equipment which largely eliminates the probability, and most of the possibility, of bad workmanship, poor materials, mistakes, accidental damage, or departure from intended structural type.

Although within the 40 years since structural steel became commercially available for architectural purposes there have been no failures of buildings caused by the deterioration of the steel framework, the safety and durability of the latter have been unjustly attacked, and some prominence has been given to untrue statements concerning it. Within a few months metropolitan newspapers have been given currency to a wholly unwarranted statement that the structural steel frameworks of tall office buildings and the like have been found seriously damaged in service. It was said that they are likely to be, or soon to be, in a highly dangerous condition; that their life is very short and that they require very frequent and extremely rigid inspection, overhauling and repairing to avoid disaster. Such is far from being the case. The erroneous statements have been fully refuted in the public press and no contradiction has been made to the refutation. The present standard practice produces steel framework of ample strength, accurately proportioned for the required service and with a high degree of perfection in design, materials, and workmanship that, under proper conditions, insures practically unlimited safety and durability. Under ordinary conditions that govern the design and construction of steel buildings, the steel will never deteriorate through working stresses, because, unlike other materials, it retains its original strength, elasticity and reliability. So much has been achieved by the metallurgist, manufacturer, designer and builder, that it remains for the architect and owner only to insure conditions and treatment that will maintain the original integrity of the structure unimpaired by any anticipated future conditions. The vital points that practically govern the durability and safety of completed structures are: corrosion, fire hazard and the proper inspection and maintenance after erection. Their important practical features are here treated.

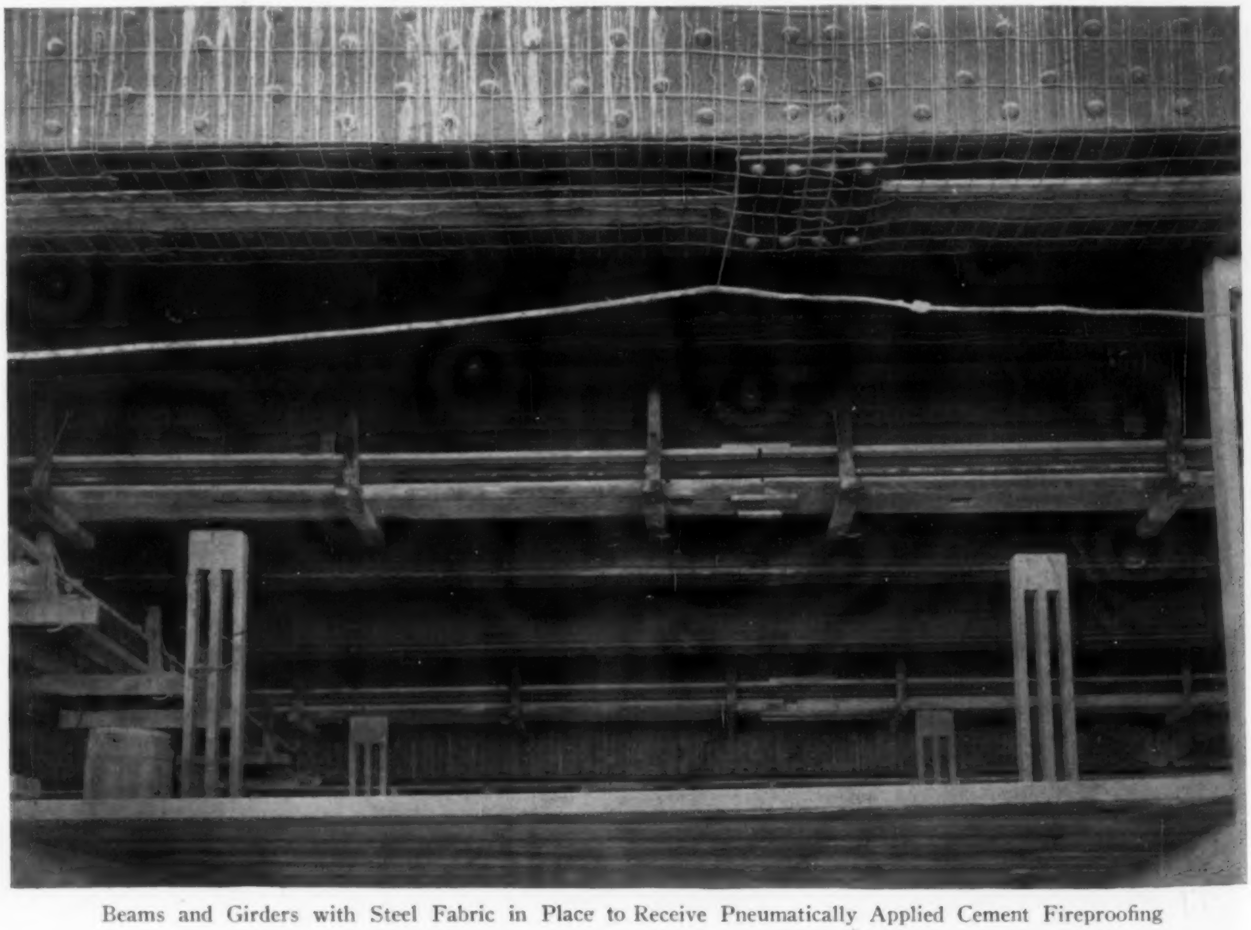
Corrosion. Under certain conditions, some of which are often continually present, all materials are subject to deterioration; wood will decay, stone and concrete will spall or disintegrate; brick and metals are subject to chemical changes that may be destructive. Almost the only agent destructive to structural steel under ordinary working conditions is corrosion, which is possible only through the presence of moisture or acids. Its prevention eliminates almost all possibility of deterioration of strength except by reason of accident, abuse or malicious treatment. Fortunately, corrosion can be absolutely prevented by keeping the steel perfectly dry and by avoiding contact with acids, fumes or liquids. Generally this is practically accomplished either by insuring a pure dry atmosphere, by encasing the steel in a solid protecting the mass, or by thorough painting. Unprotected steel should not be imbedded in cinder concrete because elements often contained in the latter are likely to promote rapid corrosion. Stone concrete or cement mortar well rammed around the steel and completely enclosing it gives a most excellent and satisfactory protection when thoroughly waterproofed. When it is applied the steel should not be covered with any oil paint, since the chemical action of the cement tends to saponify the oil and makes the paint injurious rather than beneficial. Unpainted steel may be covered with graphitic or asphaltic paint, which is often used for steel in footings, in foundations, and when exposed to wet earth. Concrete encasement is also suitable for the protection of superstructural steel when it is desirable for architectural or other purposes and

where it is properly applied, secured and waterproofed. The first inspection is likely to be the last.

In general, structural steel of all sorts may be satisfactorily protected by thorough painting. Before the first coat of paint is applied, the steel should be thoroughly cleaned; grease, scale and all dirt, old paint or other substances removed either by scrapers, wire brushes, washing or sand blast, and it should immediately after be treated with one or two coats of red lead and oil thoroughly applied on a warm, dry surface. This paint should be protected by one or two coats of some good elastic paint such as white lead and oil or other standard metallic paint. When columns, lintels, girders and other members are enclosed in outer walls, whether of concrete, or brick or stone masonry, the latter should be thoroughly waterproofed on their outer surfaces. They should be provided with horizontal water stops over horizontal members, and the steel members themselves should be thoroughly parged with cement mortar and the space between them and the masonry slushed full of mortar.

Some railroads and certain interests having large quantities of structural steelwork to preserve have developed special formulæ for their paints. It has been found that under different atmospheric conditions, different formulæ are necessary, since a paint giving excellent protection in one place may not do so in another place. Paint for the steelwork enclosed in buildings is, however, much easier to select and more durable than that applied to outside structures such as bridges. When repainting any structure, it is very necessary to first thoroughly clean it and especially to remove all dirt and rubbish. Cavities, pockets and narrow clearances likely to retain dirt or moisture should be filled with solid cement or some other waterproof material to protect the paint and prevent the accumulation of moisture or the development of corrosive acids from decaying materials. Where the steelwork is thoroughly protected by concrete or masonry covering, or where it is exposed in a dry atmosphere under cover, the original paint may remain effective for many years, and practically require renewal only for decorative purposes; but where the steel is exposed to wet or salty atmosphere, the fumes of cooking or any other acid condition, it should be frequently inspected and have thorough painting as often as the paint may show signs of deterioration. Originally exposed steel in the interiors of buildings will not require frequent painting, but exposed work may require painting every two or three years or oftener. If thoroughly painted with good materials and at sufficiently frequent intervals, it will afford complete protection for the steel against corrosion.

Fire Hazard. Steel is uninjured by ordinary atmospheric temperatures. Its strength is normal up to 200° Fahr. and increases about 25 per cent as



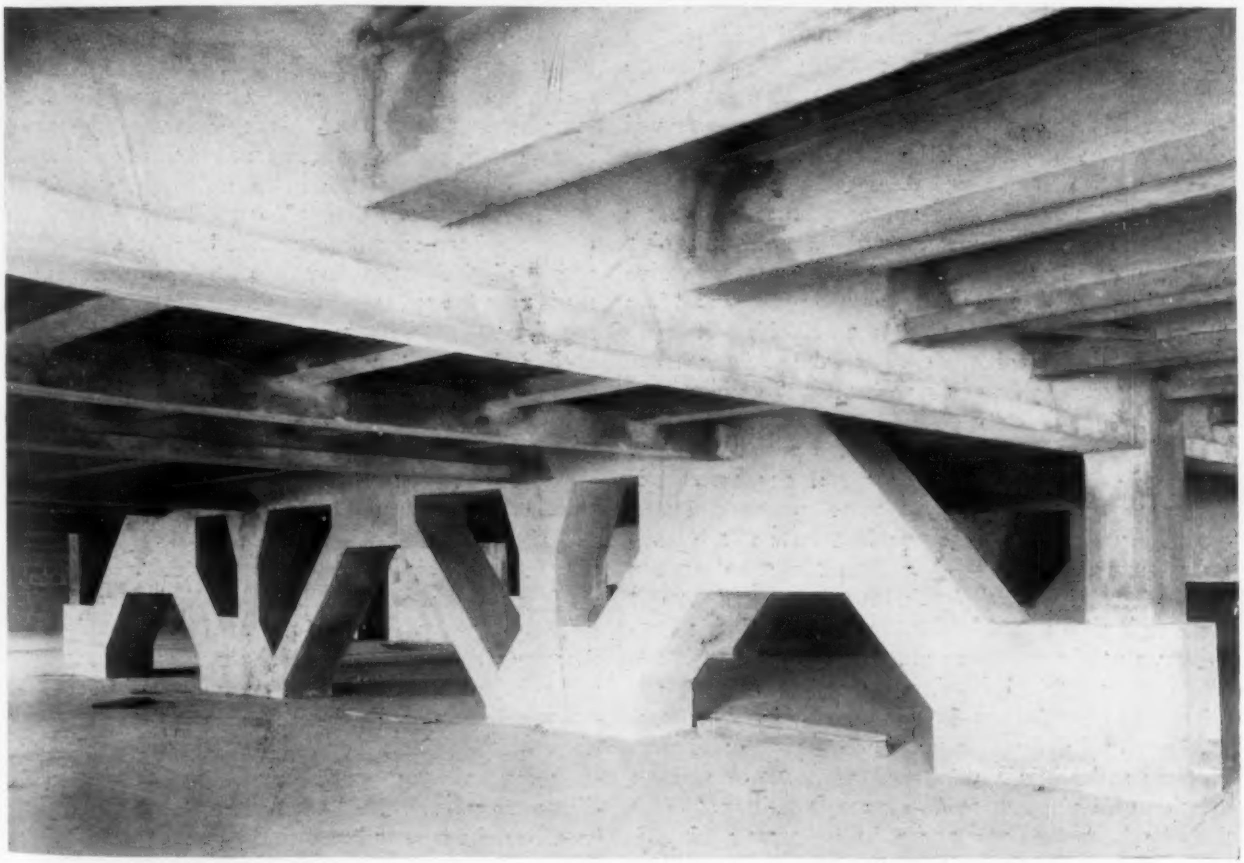
Beams and Girders with Steel Fabric in Place to Receive Pneumatically Applied Cement Fireproofing

the temperature rises to 500°, decreasing to normal at 800°, and to less than half the normal (to approximately the maximum permissible working stress in columns) at 1000° Fahr., above which temperature it should never be called on to carry compressive stresses. Steel is fireproofed by casing it in a complete, durable, strong covering of incombustible, refractory material that may or may not enclose an air space around the steel. Usually the encasing material is brick, tile, gypsum or concrete, with a minimum thickness of from 2 to 8 inches. If concrete is used, it should be reinforced and anchored to the steel. Concrete may be poured in moulds, or may be plastered by hand, or installed by pneumatic pressure, which increases the strength and density of thin bodies of concrete.

Most large American cities and several insurance companies and technical organizations have prepared very careful specifications to govern the fireproofing of steel structures. The specifications recently issued by the American Institute of Steel Construction provide that: "Fire-resisting insulating material shall continue to function within the temperature range of its use, and shall be so applied that it will not crack, spall, or buckle to seriously expose the steel to direct heat from fire. If the insulating of columns contemplates the use of air spaces between the steel and the insulator, there shall be fire stops placed at the floor levels. Steel buildings whose condition of exterior exposure and whose contents under fire hazards will not produce a temperature greater than 800° Fahr. in the steel shall be considered fire resisting without insulating protection for the steel. If the steel has an insulating protection, the safety factor shall be based on the fireproofing material providing protection for a greater period of time than the combustible contents of the building will burn, as shown in Section 3 of this specification; 16 pounds per square foot of combustible materials including wood floor and wood trim, constitutes a 1-hour fire hazard, 30 pounds a 3-hour hazard, 40 pounds a 4½-hour hazard, etc. The safety factor for all skeleton frames and secondary members shall be 1½. For example, if a building contains 10 pounds of combustible material per square foot of floor, and has a fire hazard of 1-hour duration, the steelwork shall be protected against the temperatures here defined for 1½ hours."

Fire Protection Specifications

The tentative 1927 specifications of the National Fire Protection Association, Boston, require that all structural steel members which support loads or resist stresses shall have a fireproof protection of brick, concrete, hollow building tile or gypsum, plaster being unacceptable. Poured-in-place gypsum or concrete shall be secured by steel anchors. Bricks or blocks shall be accurately fitted and bonded, and the spaces between them and the structural steel shall be filled solid with masonry or concrete. Bricks



Encasement on Beams and Girders is Solid, but that on Truss Members is Hollow, Enclosing Air Spaces

or blocks are to be set in Portland cement mortar except gypsum mortar for gypsum blocks. All columns and girders shall be protected from corrosion. No pipes, ducts or wires shall be placed within the fireproofing area. All wall columns shall be enclosed with not less than 3¾ inches of brick or 3 inches of concrete well bonded and anchored. Fireproofing of wall girders shall be the same as for wall columns. Interior columns shall be enclosed in a continuous casing of concrete 3 inches thick, or cast-in-place gypsum not less than 2 inches thick. Where subject to mechanical injury from trucking, handling merchandise, etc., fireproofing shall be protected by jacketing. Webs and bottom flanges of interior girders and trusses shall be protected with fireproofing not less than 2 inches thick at all points. Beams, lintels, and all other structural members except roof trusses and roof purlins shall be similarly protected with fireproofing not less than 1½ inches thick. Minor structural members supporting walls or other construction shall be protected by not less than 1 inch of expanded metal or wire lath and cement or gypsum plaster.

The requirements of the building code of the National Board of Fire Underwriters correspond in general to the specifications of the Fire Protection Association and say that hollow building tiles for fireproofing must have webs and shells not less than ⅝ inch thick. Galvanized steel wire, not less than 12 gauge, shall be securely wrapped around block column coverings so that every block is crossed at least once by a wire. The wire shall not be wound spirally, but each turn shall be a separately fastened unit. Interior metal ties or interlocking blocks are preferable to the wire winding. No blocks shall exceed 12 inches in vertical dimension. Hollow tile protection for the lower flanges of beams, etc., shall be either dovetailed to or integral with the skewbacks, with solid mortar joints. All concrete protection shall be anchored to the structural steel member with interior pieces securely hooked to the enclosed members.

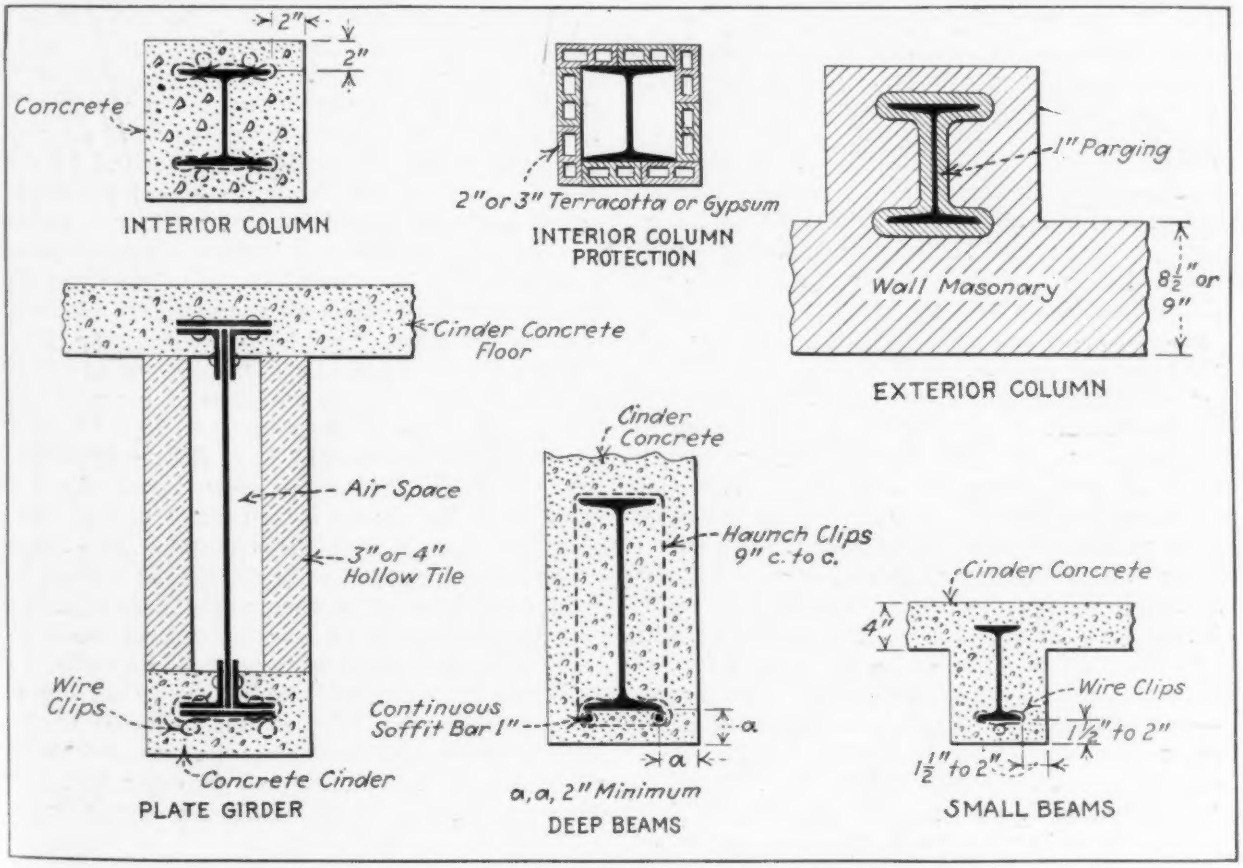
In discussing the most efficient type of fireproofing for structural steel columns, H. G. Balcom, consulting engineer, recommended a solid jacket of limestone concrete anchored to the column flanges.

Long Roof Trusses of Madison Square Garden in Perfect Condition after 35 Years of Service

A very popular alternative is the use of terra cotta blocks on all sides of the column. He recommended for ordinary beams a solid encasement of anchored concrete integral with the floor or ceiling slabs. For deep girders, the bottom flange may be protected by cinder concrete and the sides by properly secured terra cotta blocks thoroughly jointed to the floor slab. Kort Berle of the Gunvald Aus Company, consulting engineers, recommended that beams and girders be fireproofed with solid concrete encasement, and that interior columns be enclosed in a solid mass of concrete or brickwork of a minimum thickness of 2 to 4½ inches respectively. Exterior columns should have one shop coat and one or two field coats of approved paint and in addition should be well parged.

There are various types of commercial fireproofing systems and details, and special provision is made to prevent the running of any pipes, wires or conduits inside the fireproofing jacket of any column or girder, entirely separate protection or chases being provided for them as is required by the building codes. Ordinary standard specifications, construction methods and equipment suffice for fireproofing concrete that is poured in forms, but to secure the durability, strength, hardness, watertightness and greatly decreased volume and weight, fireproofing pneumatically applied to any steel members should be made with the proportions of one bag of Portland cement well mixed with 3 cubic feet of dry screened sand under a minimum pressure in the receiving chamber of 30 pounds, mixed at the discharge nozzle with clean water at 60 pounds, and delivered at right angles to the fireproofed surface. The fireproofed members must be thoroughly cleaned of all paint, grease, rust, etc., and have ½-inch holes approximately 3 feet apart in the webs close to the top and bottom flanges. Anchor rods shall be secured through these holes, and to them longitudinal rods shall be attached and wired about every 12 inches to galvanized welded fabric or expanded metal of required size and weight that has been carefully cut to size and bent over templates so as to closely follow the outline of the member and insure a minimum thickness of ¾ inch of protection.

The outer edges of flanges and stiffeners are squared to true lines by the use of detachable "shooting strips." The main surfaces of girders, beams, columns, etc., are trued before the cement sets, by cutting off all high spots with the sharp edge of a trowel and dragging the surface with a wide, long-haired, wet, whitewash brush. Cement must not be placed during freezing weather, nor against frosty surfaces, and it must be kept wet for at least one week after placing. In no case shall the thickness of the cement be less than 1½ inches on vertical surfaces and above horizontal surfaces, and not less than 2 inches below bottom surfaces and around edges of lower flanges. Thickness shall be measured from the surface of the steel and not from the tops



Types of Fireproofing for Columns, Beams and Girders

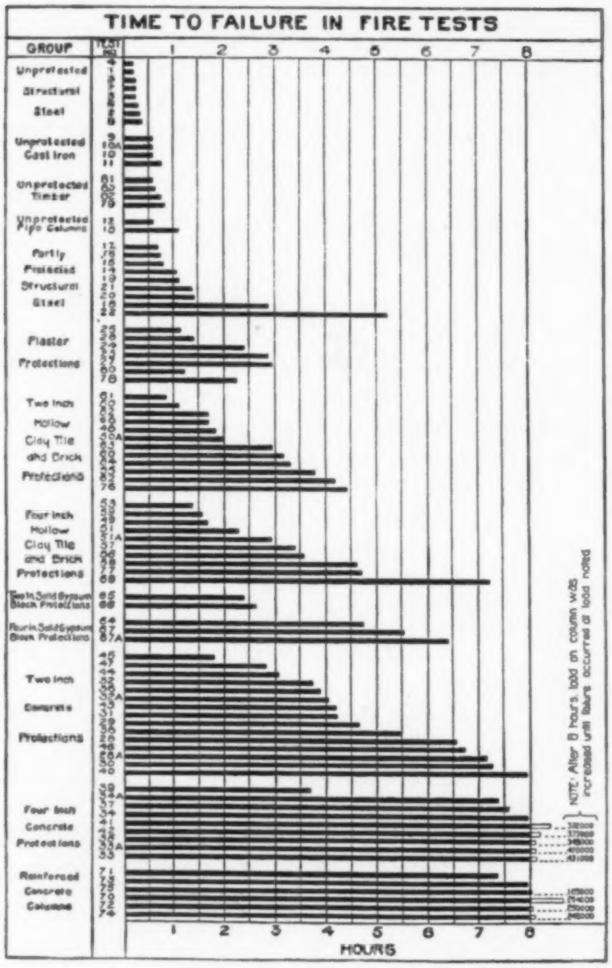


Table of Results of U. S. Bureau of Standards' Test of Columns and Fireproofing

of rivet heads. A Columbia University test of a pneumatically built cement slab was made with an average temperature of 1695° Fahr. for three hours, combined with a load test of 40 pounds per square foot, and after cooling, a load test of 200 pounds without failure, the 200-pound load producing tensile stresses of 7,450 and 62,000 pounds per square inch in the concrete and steel, respectively.

Examples of Steel and Wrought Iron Buildings. No deterioration was observed in small wrought iron beams removed after nearly 100 years' service in an old shot tower in New York. The roof trusses over the main shop of the Dominion Bridge Company, Montreal, erected in 1884, have been seriously overloaded, exposed to very injurious smoke and fumes, seldom repainted and never reinforced, yet they are still in service, and are considered to be in good condition. The Woman's Temple, one of the first so-called steel frame buildings in Chicago, was removed after 33 years, and only very slight deterioration was found in any of the steelwork. The Tower Building on lower Broadway, erected in 1888, was called the first steel cage building in New York, and its I-beams were in good condition when removed after 26 years' service. After 30 years' service the steelwork in the Benoist Building, St. Louis, was found as good as the day it was erected. I-beams in the Rand & McNally Building, one of the first tall buildings in Chicago, were recently exposed during its demolition and found uninjured. About 300 tons of steel I-beams were salvaged and re-used in new building construction after 25 years' service in a New York hotel. When recently demolished to make room for modern structures, the steel frameworks of the Savoy, New Netherland, and Delmonico Buildings, New York, were found in good condition. Well protected steelwork, although exposed to dust, moisture, and sulphurous fumes, does not show deterioration in two generating stations and 15 sub-stations about 30 years old of the Brooklyn Edison Company, the framework being now in perfect condition. On a 40th Street, New York, sidewalk, I-beams, only partly waterproofed, showed no deterioration after 20 years' service. Foundation girders in the Samson Building, New York, were painted with graphite and asphalt, and were found uninjured after 22 years' exposure to drip and moisture. Many hundred tons of structural steel and iron were used in the roofs, floors, columns, and great trusses of the famous Madison Square Garden, New York, which was built about 35 years ago. When it was razed in 1925, careful inspection was made of its framework, and except for a very small portion of the ornamental top of the tower (perhaps 1 per cent of the whole) that was exposed, unprotected, seldom or never visited, and entirely neglected, all of the steel and iron was found in perfect condition; as good as new. Large quantities of the I-beams were salvaged for re-use, and the great long span roof trusses were very carefully removed and stored for re-erection in a new building. Generally the I-beams provided by the demolition of old buildings are salvaged, cut to required lengths and sold for erection in new buildings. Columns, girders and other fabricated members could also be salvaged if their details and dimensions were adaptable to new work.

Jacob Volk, New York house wrecker, says: "In the demolition of more than 200,000 tons of structural steel and iron, the condition of the steel has been found, in general, excellent, and 90 per cent of the floor beams are reused." E. A. Prentis, president, Spencer, White & Prentis, New York, who for many years has done a large amount of underpinning, exposing old foundations at and below ground water level, says: "Usually the steel in them is in good condition; never dangerously corroded. In designing thousands of foundation piles made of heavy steel pipe, filled with concrete, an excess of 1/16 inch in thickness is ample to allow for corrosion. That portion of the unpainted pipe driven into clay or firm soil sometimes does not corrode at all, but usually the exterior does corrode a little, and the corrosion ceases, the oxidized steel combining with the earth to form a hard, dense jacket, resembling iron ore, that, when knocked off, discloses a

bright, smooth, clean, uninjured metal surface, apparently free from progressive corrosion. This condition has been repeatedly observed in the oldest piles of this type in New York that have been in service 20 years or more." Answering charges of deterioration of the famous Eiffel Tower, erected in an exposed situation in Paris, M. Hubie, Chief Engineer 16th Arrondisement, Paris, and Secretary of the Eiffel Tower Inspection Committee, recently wrote: "We do not see any reason why the Eiffel Tower should not last indefinitely if properly cared for," and C. Marc, C.E. Administrator of the Eiffel Tower Society, says: "The Tower is in as good condition today as the day it was built."

In an exhaustive research of structural steel in the United States and Canada, conducted in 1926 by the writer for the American Institute of Steel Construction, a questionnaire of 63 interrogations on their practice, observation, records, opinions and beliefs regarding the principal features of the deterioration, durability, and best maintenance of structural steel was addressed to more than 1,000 of the most eminent engineers, architects, and builders in this country and Canada. From about 17,000 items of replies received, and from conferences with, and letters from more than 200 prominent architects, engineers and contractors of long experience in New York, Boston, Philadelphia, Chicago, San Francisco and other cities, these details were tabulated:

The safety of a structure in general is not endangered by corrosion.

There need be no fear of serious results from corrosion in well designed and maintained buildings. Serious corrosion in buildings would become obvious to reasonable inspection before the building could be endangered.

The worst peril from corrosion is due to accumulation of dirt and filth, from exposure to moisture, salt air, acid fumes, brine, and other artificial conditions.

All steel may be protected from corrosion.

The protection of buildings from corrosion may be 94 per cent perfect.

The best protection from corrosion is afforded by painting and cleaning.

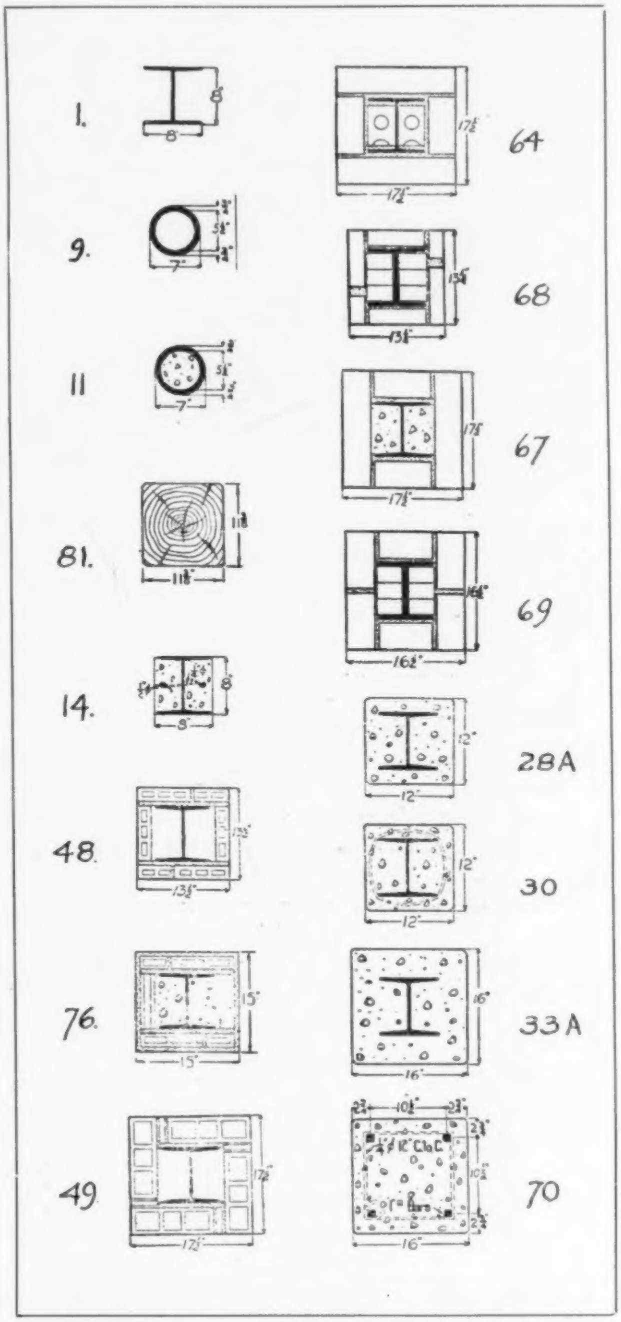
Very efficient protection from corrosion may be afforded by enclosing it in dense, fine, stone concrete.

Unless buried or encased in concrete, steel should be protected by a priming coat of red lead paint followed by an elastic coat of waterproofing paint. Graphite or asphalt paint should be used rather than oil paint on steel enclosed in concrete.

Exterior walls containing steel members should be waterproofed, and stop courses built over lintels and wall girders.

There is no limit to the life of properly protected steel.

The worst neglect causing corrosion is failure to keep it clean and dry, and failure to provide good and adequate painting.



Sections of Several Columns Tested (Numerals Refer to Test Numbers of Table on Page 574)

There is practically no danger of corrosion from electrolysis.

The actual values and comparative efficiencies of different types of fireproofings on different steel columns have been thoroughly investigated by a recent series of official fire tests on building columns, etc.

Official Fire Tests of Structural Steel Columns. "Fire tests of Building Columns," Paper 184, published April 21, 1921, by the U. S. Bureau of Standards, describes in great detail 96 tests of structural steel columns made in Chicago in 1917 and 1918 under the joint direction of the Associated Factory

Mutual Fire Insurance Companies, the National Board of Fire Underwriters, and the United States Bureau of Standards. They were made to ascertain, first, the ultimate resistance against fire, of protected and unprotected columns as used in the interiors of buildings; second, their resistance against impact and sudden cooling from hose streams when in a highly heated condition. The columns were of ten standard cross sections, with cross sectional areas varying from about 7 to 14 square inches, lengths of about 12½ feet, and designed for working loads of approximately 100,000 pounds. They were tested without protection; partly protected by concreting interior and re-entrant spaces; protected by 2-inch or 4-inch thicknesses of concrete, hollow clay tile, clay bricks, gypsum blocks; and by single or double layers of metal lath and plaster. The load pressure was uniformly maintained while the columns were heated in a gas-fired furnace whose temperature rise was regulated to conform with a predetermined time-temperature relation. Elaborate measurements were taken of the temperatures of the furnace and test columns, and of the deformations of the latter, due to load and heat.

Firproofing was applied so as to reproduce, as nearly as possible, conditions obtaining in building construction. The machine-mixed concrete was spaded inside the forms which were tapped with hammers. The overtapping joints of wire lath were wired, the lath was supported on ⅜ x ¾-inch channels, and the plaster coats were of maximum thickness. Hollow tiles and bricks were set in cement mortar, and when concrete was placed between tiles and column, the tiles were held in place by clamps 2 feet apart. Gypsum blocks were set in 1:3 gypsum mortar. The load pressures were applied by a hydraulic ram of 545,000 pounds' capacity and an accuracy usually within 1 per cent. The 7 x 7-foot brick testing chamber 12 feet high had four primary gas burners in the corners that were supplied through a 6-inch pipe from the city mains. Two of the furnace walls were movable to permit the application of a stream of cold water delivered through a 1⅛-inch nozzle. The columns in the fire test series were subjected to a constant working load and fire exposure, increasing according to a predetermined time-temperature relation until failure occurred, or until they had withstood the test eight hours or more.

In the fire and water tests, the working load was maintained constantly, and the column exposed to fire for a predetermined period when water at given pressures was applied by means of a hose stream. In case the columns withstood the fire test, they were immediately loaded to failure under full fire exposure. In the fire and water tests, three columns were loaded to failure after they had cooled, and four columns were loaded to twice the applied working load and then reserved for further tests. The time to failure in the fire test extended from the beginning of the test to the time when the column was unable to sustain the working load. The duration of the fire and water test period varied from 22½ minutes to one hour, and that of the subsequent water application from one to five minutes. The length of the maximum period of fire was the time within which the water is generally applied in building fires, estimated at one hour.

Maintenance. In order to insure the continued integrity of the steel framework of a building that has been properly designed, constructed and protected as has been here described, it is necessary that it should receive adequate periodical examinations and such maintenance as is required to prevent any injury or to correct any incipient trouble. Certain portions of the structure,—such as the steelwork in the foundation and footings and the steel embedded in exterior walls scrupulously protected with adequate covering,—are undoubtedly permanently safe, and need never be disturbed, notwithstanding the hysterical demands of a newspaper which insisted that the walls and foundations of important structures should be frequently torn open.

Wherever there is reason to fear the penetration of corrosive liquids, gases or moisture, there should be preventive measures taken. Ordinary corrosion, though it may present a rough and a scaly exterior, is seldom structurally important, unless long continued, and a very rough surface may not indicate the loss of 1 per cent of the original strength and efficiency of the member, an amount which is entirely admissible without impairing the safety of the steel. Extreme cases of excessive and prolonged corrosion may demand the replacing of the member. Usually a casual examination of the most exposed and vulnerable parts of the interior framework will indicate whether corrosion is present, and if found, it generally is necessary to repaint only the member and maintain the required protecting jacket to insure its safety. When local spots of corrosion are detected, they should be removed immediately and the places covered with one coat of red lead and oil plus the application of an additional coat of paint entirely covering the structure or members.

Exterior steelwork must be carefully and thoroughly inspected at intervals of from three months to one year, according to the character of the structure and the conditions obtaining. Two kinds of metal must not come in contact where there is a possibility of there being moisture. There should be no narrow spaces between or around steel members or portions thereof, and there should be no contact with dirt, rubbish, or any other materials at places where moisture or filth can accumulate. If such are inevitable, they must always be frequently exposed and cleaned, unless it is possible to eliminate them by filling with solid waterproof, watertight materials. The greatest care must always be taken to keep steelwork clean and dry. Accumulation of any kind of dirt or rubbish must never be permitted. If it is kept clean, and dry, and well painted, the steel's working life should be unlimited. Proper protective encasing of steel insures its structural integrity.

LINOLEUM AND CORK COMPOSITION FLOORING MATERIALS

BY

C. STANLEY TAYLOR

RESILIENT flooring materials are the outgrowth of a definite need for a suitable and economical floor over wood, concrete and other hard floor surfaces, and for a material which can be easily applied as a replacement floor over old floors of any type. Cork composition products and rubber are the principal flooring materials having resiliency as a dominant characteristic. They have been evolved through many years of development and improvement, and have today reached a state of perfection and quality which places them very definitely in the class of quality materials having distinctive characteristics not present in similar combinations in any other type of floor surfacing material.

We are concerned in this discussion primarily with cork and cork composition floorings, which are known in the trade under the general titles of linoleum, linoleum tile, natural cork tile, and cork carpet. The evolution of cork composition flooring materials from the status of a floor cover to that of a finished flooring material has been slow, and architects have only recently awakened to the intrinsic values which such materials possess as contrasted with their use primarily as substitutes or replacement coverings. It must be acknowledged today that these products have earned for themselves a definite, permanent place in the building field, and that they offer to architects, builders and owners new opportunities for creating special effects in color, pattern and texture and for introducing other values of comfort, quietness, sanitation and maintenance that particularly adapt them to solving many modern flooring problems.

Types of Cork Flooring Products. The various types of resilient flooring materials, of which cork in some form is the principal component, each possess special characteristics which make it important to differentiate one from the other, both in this discussion and in the use and specification of such materials. The prevalent use of trade names to distinguish the various types of products is somewhat confusing, and we must go back of the distinguishing and commonly employed trade names and classify the products in another manner. There are three major classes of cork flooring products; (1) cork composition floorings, broadly termed linoleums and linoleum tiles; (2) natural cork tiles; (3) cork carpets. Their characteristics deserve consideration.

Natural Cork Flooring Products. Cork tiles are composed of particles of cork, such as the thin shavings of cork which are largely produced as a by-product in the manufacture of cork bottle stoppers. These particles are compressed under heat in such a manner that the natural gums of the cork are liquified and form the only binder required to produce a firm, rigid, and homogeneous product. The better grades of natural cork tile contain nothing but pure cork without any of the harder bits of cork bark or other foreign ingredients. The tile forms come in various size, usually in square or rectangular shapes, and in thicknesses ranging from approximately ¼-inch to ½-inch.

Natural cork tiles take their color from the cork itself and from the baking process which is essential to their manufacture. They are thus available only in natural cork browns of various shades, ranging from light to dark, according to the amount of heat applied. The extreme hydraulic pressure usually employed in the manufacture of cork flooring produces a material which is quite resistent to wear and abrasion, and which is at the same time highly resilient, quiet, and pleasant to walk upon.

Cork Tile Showing Random Use of Several Shades

Embossed Inlaid Linoleum Resembling Tile Floor

Embossed Inlaid Linoleum Indicating Adaptability to Definite Architectural Styles

Cork Composition Flooring, Linoleum. In this type of flooring ground cork is a principal ingredient. The cork is pulverized almost to the fineness of flour and is mixed with oxidized linseed oil and various gums, fillers and pigments. The mixture is compressed under huge heated calendar rolls onto a burlap backing employed as a measure of reinforcement on the underside. A process of curing the cork composition aids in producing a firm, homogeneous material of considerable resiliency which will not buckle or crack and which is practically free from odor. Cork composition floorings are available in many forms and in a number of distinct types. The sheet forms may be classified as Battleship Linoleum, Jaspe, Inlaid Linoleum, Embossed Linoleum and Marbleized Linoleum.

Battleship Linoleum is a high quality, plain color cork composition flooring in sheet form, which earned its name from its original use as a decking material over the steel decks of warships. It is available in various thicknesses from slightly less than ⅛-inch to a full ¼-inch.

Jaspe Linoleum is distinguished by its striated pattern in two tones of a single color, giving a variegated effect and a characteristic appearance of graining. It is otherwise similar to Battleship Linoleum in its composition, and is usually available in three weights. Small insets of contrasting color are frequently used in Jaspe Linoleum with interesting effects.

Inlaid Linoleums have various patterns in which each individual color runs through to the burlap back. In surface appearance these linoleums often resemble a floor laid with individual tiles, but possess the advantage of lower initial cost and considerably lower laying cost because of its sheet form. This type of linoleum is available in many combinations of colors and in a wide variety of patterns, some of the small tiles forms resembling mosaic tiles, and some patterns resemble quarried tiles or blocks of cut stone or slate, as well as other designs.

Embossed Linoleums are usually inlaid linoleums in which an apparent joint is introduced between the tile units of the pattern, and this joint is compressed below the surface of the sheet to give the appearance of a masonry joint in a hard tile floor. The tiles themselves may also be embossed for decorative effects.

Marbleized Linoleums are classified separately because of their special appearance. Ingenious processes of manufacture result in producing a variegated color effect which resembles with remarkable fidelity the color and appearance of fine marbles, there apparently being no limitation to the manufacturing process in the reproduction of all types of colored marbles. Marbleized Linoleums may be in either full sheet forms, in which the marbleizing effect is carried out over the entire sheet, or of the inlaid type, having the appearance of blocks of marble laid in pattern.

The tile forms, which are sold under various distinguishing trade names, are essentially the same as in the sheet forms in composition but are usually available only in plain colors or in marbleized effects. There are in addition a number of newer types constantly being developed which produce various special flooring effects, including a reproduction of wood plank floor, accomplished by using the Jaspe Linoleum with inset joint strips, pegs and butterfly wedges of darker color. The tile forms are in plain colors and in marbleized effects. Some manufacturers are producing an embossed tile for special uses which have the appearance of decorative faience tiles and which are employed to introduce variety and interest in the pattern of a floor. The architect has at his disposal, in these materials, floorings to harmonize with any designs.

Cork Carpet. Though frequently classified with linoleum, cork carpet differs somewhat from both cork tiles and linoleums. It is composed of granulated cork using a different proportion of cork and linseed oil from that usually employed in Battleship Linoleum. It is compressed under heat. As the name implies, it is manufactured in sheet forms. It comes in several solid colors, and in thicknesses of approximately .22-inch (polished) and .26-inch (unpolished). Cork carpet has not the density nor therefore the resistance to wear of the several types of cork composition flooring materials, but its great resiliency and relatively low cost give it a very

definite utility for solving certain flooring problems.

These classifications cover the principal standard types of cork composition flooring, but it should be noted that each individual manufacturer is constantly developing new combinations and new patterns which have their special uses from both the decorative and service point of view. The essential features here noted, however, may be applied to the newer forms, and hence an extended discussion of them is not necessary before we proceed to the next consideration.


Border of Marbleized Linoleum as a Transition from Inlaid Marbleized Pattern to Embossed Tile Pattern

An important new development in the manufacture of linoleum and cork composition flooring materials is the utilization of pyroxylin or nitrocellulose lacquers to produce a surface wholly impervious to moisture, dirt and to the staining effects of many common materials such as ink, foods, greases, mild acids, and even synthetic gin. The lacquer finish is not merely a surface painting in the ordinary sense, for the leading manufacturers while retaining in secrecy the exact nature of the process employed, claim and demonstrate that there is a certain amount of penetration of the lacquer into the upper strata of the material, although no manufacturers claim complete penetration. The lacquer functions to close the minute pores in linoleums and other cork composition flooring products so that ordinary dirt and dust will not be ground into the surface, vastly simplifying the cleaning and maintenance operations. The nature of the lacquer employed is such that most common substances which will normally stain wood, marble, concrete and other types of flooring will not penetrate into the cork compound, and a spot can be readily wiped off from the surface without leaving any stain or mark. To a large extent the lacquer treatment eliminates or minimizes the need for waxing linoleum floors for their maintenance and preservation, although wax may be applied as usual if desired. Undoubtedly this new development marks a real advance in improving the life and utility of cork composition flooring materials, giving added qualities of sanitation, low maintenance cost, improved appearance and probably greater durability.

Appearance and Service Characteristics. While architects universally appreciate the decorative importance of floors in every type of room where architectural design deserves the least consideration, they also know that the selection of flooring materials must depend also on many service factors, including durability, safety (which means freedom from excessive slipperiness when either wet or dry), ease of maintenance, ease of replacement, sanitation, quietness and comfort, and economy. To a surprising degree, cork composition and linoleum floorings possess the qualities of an ideal flooring material. It is hardly necessary to stress the appearance factor. The variety of colors and patterns available, not only in the sheet forms of linoleum, but also through the employment of the tile forms with which the architect can develop individual patterns to meet the specific design problems, is equaled by no other type of flooring. Color in almost unlimited variety is available in all forms except Battleship Linoleum, cork carpet and natural cork tile; the latter being confined to natural brown tones, and the first being available only in a limited number of plain colors, though special colors can be produced on large orders. The use of sheet linoleums and the tile forms in combination, one for the border and the other for the field, and the opportunities for developing special patterns by inlaying the sheet forms with decorative units of almost any required shape and color, gives further versatility to this type of flooring and challenges the ingenuity of the architect to create decorative effects appropriate to every architectural style, and to every design problem.

We have already noted the inherent resiliency of cork composition products, which is responsible for their making an exceptionally quiet and comfortable floor. From the safety angle, linoleum and cork flooring materials possess the well known non-slipping characteristics of plain cork when either wet or dry. The use of a wax finish for maintenance purposes introduces a slight hazard, but if the wax is thoroughly rubbed in and polished it does not pre-

Special Pattern Set in a Marbleized Linoleum Floor

sent a slippery or dangerous surface. Linoleums also possess sanitary qualities in a high degree, particularly those which have been manufactured with the lacquer treatment.

Maintenance of linoleums and other types of cork and cork composition flooring is largely confined to waxing at periodical intervals and to dry cleaning with a soft brush on all other occasions. The use of caustic or gritty soaps or scouring compounds is both unnecessary and positively harmful to these flooring materials and should never be permitted at any time, though the newer forms employing the best lacquer treatments are not likely to be harmed. Occasional washing with a mild household soap, washing a small area at a time and following the washing by immediate wiping with clean water, is permissible a few times a year, but the waxing process alone should be sufficient to remove surface dirt and leave a clean and fresh surface. Many of the difficulties that have been encountered with linoleums in the past have been due to the excessive use of water and strong soaps in their daily maintenance. These service characteristics are accompanied by ease of replacement where worn spots must be removed, a feature particularly notable with the tile forms, one or more of which can be readily taken up and replaced without relaying the entire floor. They are also accompanied by the important factor of considerable initial economy, for linoleum and cork floorings are less expensive than any other type of finished flooring material or floor covering, having equal characteristics of quality, durability, resiliency, color and pattern.

Proper Use of Cork Composition Floorings. The selection of flooring materials is properly based upon their characteristics and cost, and it is hardly necessary to itemize the types of floor space for which linoleums, cork composition tiles and pure cork flooring materials are adapted. It is sufficient to note that they have properly come into general use in residences of all types, and in any room, not as a substitute material, but primarily because of their distinctive features which adapt them to both the decorative and service requirements of domestic interiors. They have earned a prominent place in commercial and institutional buildings, particularly those which have concrete structural floors, because of their resiliency, comfort and quietness, their ease of maintenance, their excellent appearance, and their low cost. The Battleship Linoleums particularly make excellent service floors in commercial, industrial and institutional buildings of all types where trucking is not required.

One precaution should be noted in connection with

Sunburst Design Set in Linoleum Floor with Striking Effect

Unlimited Variety Is Possible with Inlaid Linoleum

the use of resilient flooring materials. Heavy furniture standing on small casters or slender legs may compress the flooring and form a disfiguring indentation which will be apparent whenever the furniture is moved. For this reason architects should take care that their clients utilize wide face casters, caster cups, or the newer types of broad faced sliding casters or gliders on all furniture, a matter that is equally important for the protection of fine wood or marble floors.

In specifying linoleum and cork composition flooring materials, the architect should be concerned primarily with two considerations. First, the service characteristics of the floor should be adapted to the traffic which it must bear. The quality of the flooring material should also be related to the service requirements, for as in the case with every other building product, there are wide differences in quality and cost, and usually the best grades are lower in ultimate cost than the cheap products.

The second consideration involves the problem of laying. It is impossible here to describe in detail the correct laying methods for each type of floor, and it is quite unnecessary to do so, for the best results are obtained when the manufacturer's instructions are made a part of the specification and where, if possible, the floor laying contractor is one whose work is approved by the flooring manufacturer. The reason for this lies in the fact that use of correct laying methods produces a far superior result,—to such an extent that the method of laying is often considered of importance equal to the quality of the flooring material. Careless contractors and those who are untrained in the work will not only use inferior cements but will frequently omit the rolling and the use of sand bags or weights to hold the linoleum or tile in place while the cement hardens.

The manufacturer's specifications should also be followed with respect to the preparation of the subfloor surfaces and to the use of suitable flooring felts under linoleums and sometimes of rosin-sized paper under cork tile, where these materials are installed over a wood floor. With these simple precautions and with careful supervision of the work, the architect may be sure of a satisfactory floor. It is never desirable, however, to lay these floors on wood or ordinary concrete in direct contact with the ground, either on or below grade.

Marbleized Linoleum in Contrasting Squares

In summarizing, it is perhaps worth while to point out the importance of these low cost resilient flooring materials as an alternative for more expensive types of flooring in those cases where the construction budget has been exceeded in the early part of a project, necessitating a reduction in finishing costs.

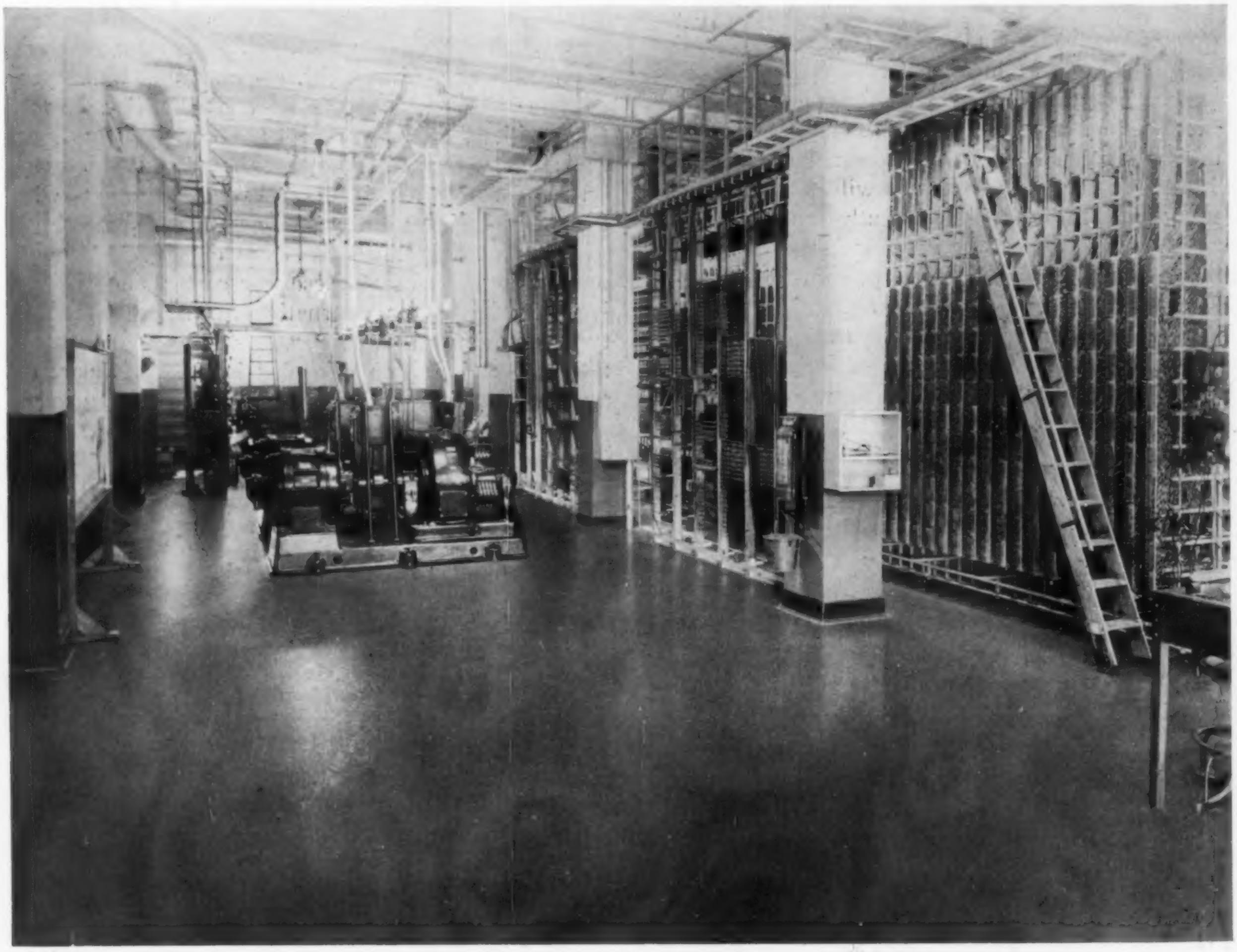
Jaspé Linoleum with Inset Pattern Used on Hospital Ramps

Cork Composition Flooring Repeating Ceiling Design

Cork Composition Flooring in Square Tile Form Used in Lobby of Small Theater

Resilient, Durable and Quiet, Cork Composition Floors Are Extensively Used in Offices

This circumstance arises so frequently that architects are often put to a severe test of their ingenuity and inventive genius to find materials which will produce a desired decorative effect and at the same time represent a substantial saving over the cost of luxurious or heavier materials having the same appearance. It is important to bear in mind that the comparative low cost of resilient cork and cork composition floorings, combined with their many excellent characteristics, renders them exceptionally well adapted to the economical flooring of all types of buildings, and in harmony with any architectural style.



Battleship Linoleum Is an Ideal Floor for Many Commercial and Industrial Uses

GAS IN THE AMERICAN HOME

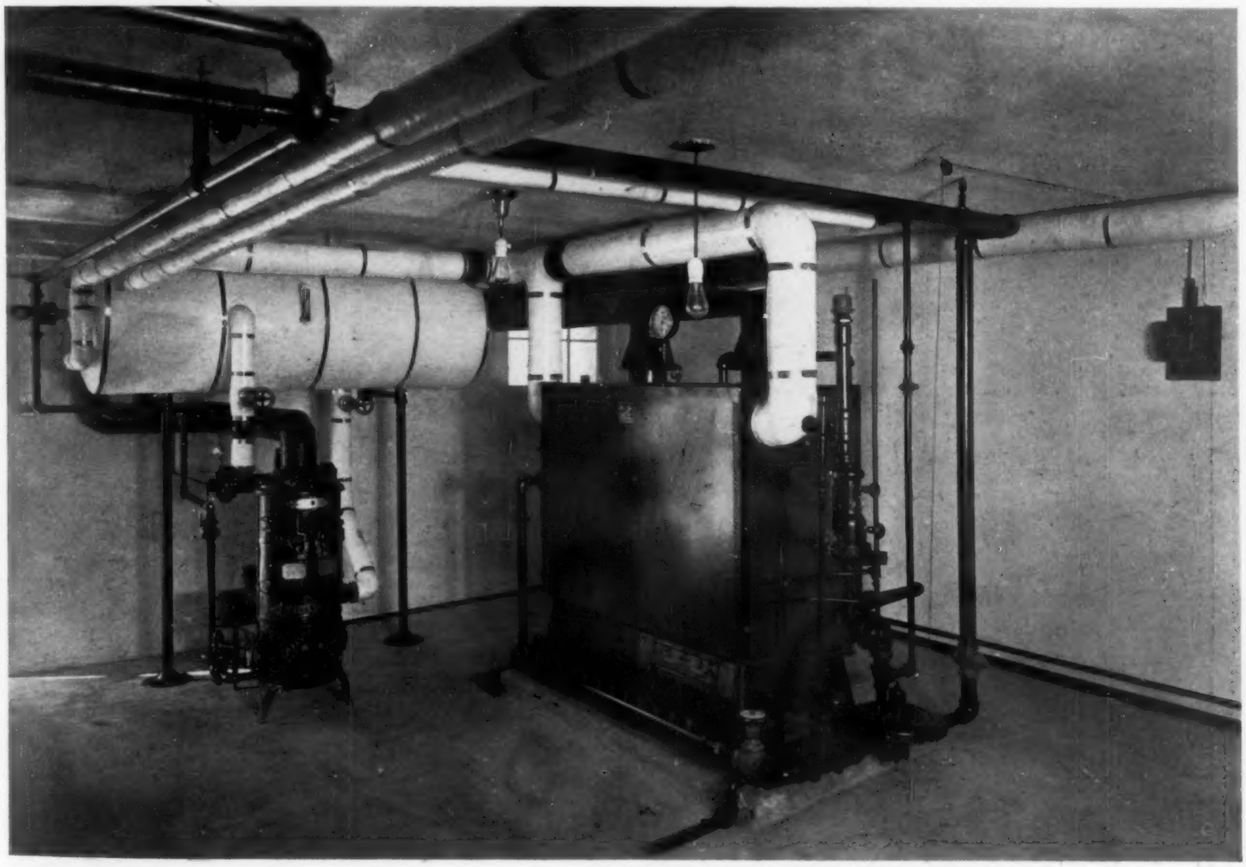
I. HEATING WITH GAS

BY P. E. FANSLER

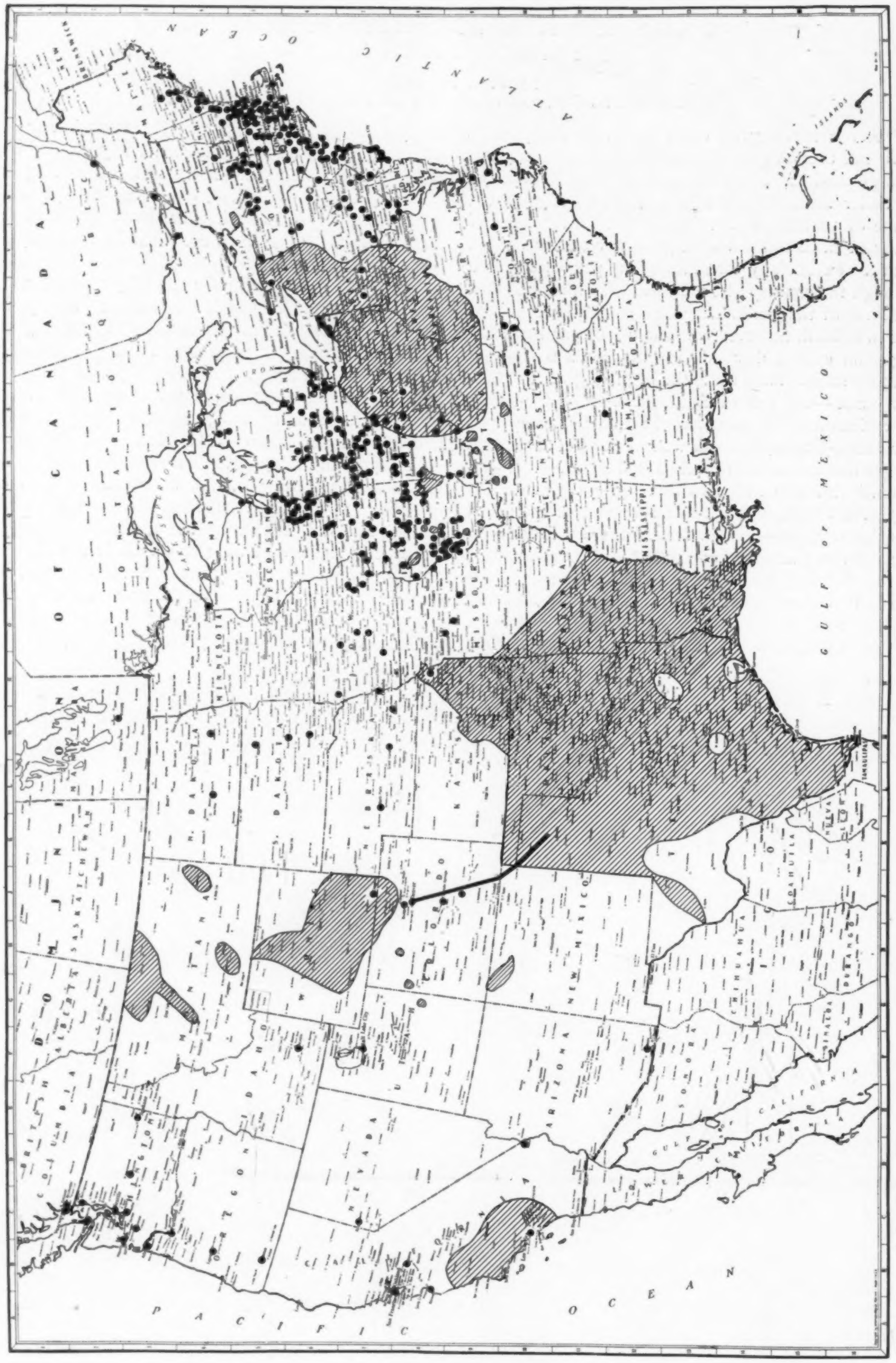
ASSOCIATE EDITOR, THE HEATING & VENTILATING MAGAZINE

GAS is serving the home owner in many ways not dreamed of when public utilities were first incorporated as "The Citizens' Gas Light Company" or under some similar title selected to suggest the scope of usefulness of this product. Executives of many of these utilities were gravely concerned when the use of electricity for illuminating purposes spread through the country like wildfire; they imagined that the knell of the gas industry had sounded. Fate was not so unkind, however, and the use of gas for cooking soon caused demands far in excess of the old lighting loads. Then came the beginning of the present phase,—the era of fluid fuels,—and far-seeing executives have already started aggressive campaigns for house-heating loads as well as for the other uses of gas that are now so much talked about,—refrigeration, incineration, air conditioning, and water heating. Also there came the development of industrial gas applications,—in laundries, bakeries, heat-treating and other metallurgical plants, for brick making, peanut roasting, and un-numbered highly specialized uses. It does seem passing strange that gas company officials wept at the thought of losing thousands of lighting customers who turned to electricity, when today there passes through a single meter, in any one of the great industrial plants, more gas than was registered in a multitude of little meters serving the house-lighting load of those old days,—and payment comes in a single check, in place of in thousands of small cash payments, with the requisite bookkeeping and accounting cost.

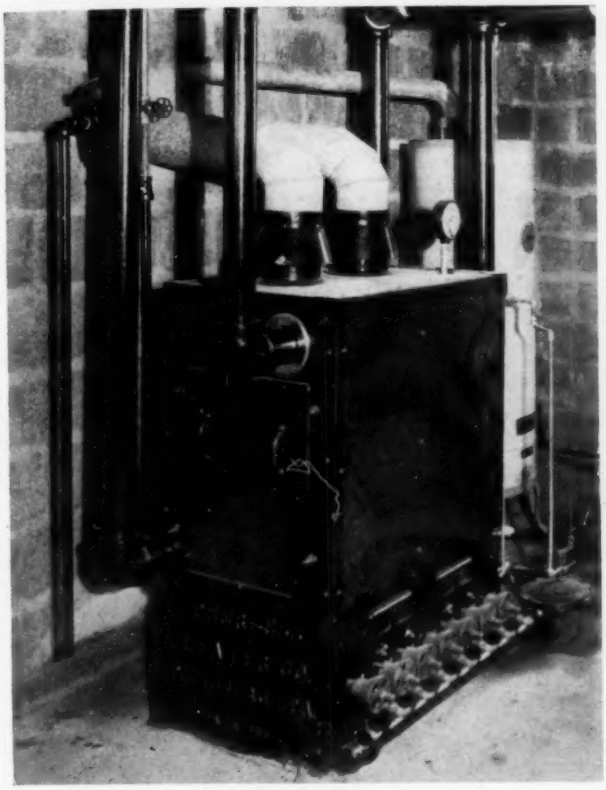
This article deals with the use of gas as a house-heating fuel; a second article will discuss the apparently paradoxical use of gas for household refrigeration as well as for the other comparatively recent applications, in the home. Househeating with gas, both natural and manufactured, is attracting the attention of the architect and heating engineer largely through a concerted and nation-wide educational campaign on the part of the organized manufacturers of gas, retailers of natural gas, and the manufacturers of gas-heating equipment. These activities were stimulated, if not initiated, by the tremendously rapid increase in the use of oil as a domestic fuel during the last three or four years. Several far-seeing executives of gas companies, in as many scattered cities, have quietly been working out the problem for the last ten or more years, and many of the



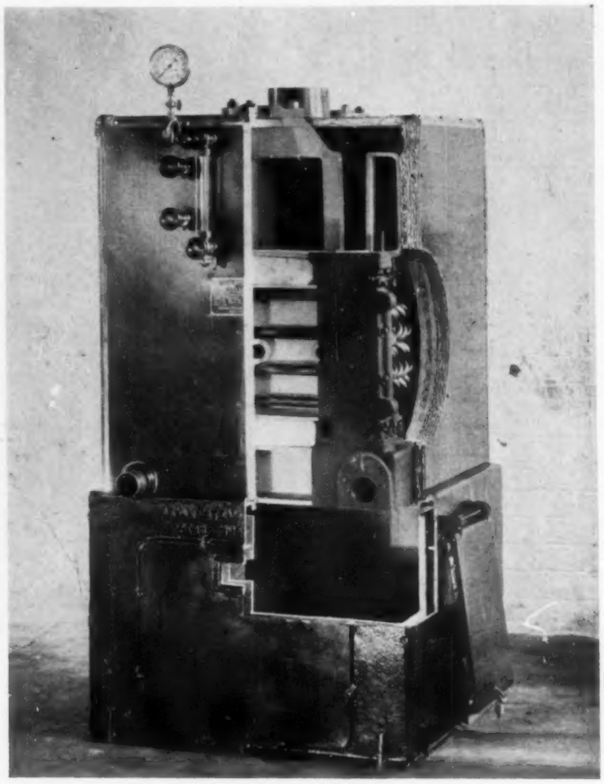
A Gas-fired Heating Plant with Automatic Control of the Steam Circulated, and Automatically Controlled Gas-heated Domestic Hot Water Supply



Black Dots Show Cities Where Special Gas Rates are in Force for House Heating. Shaded Areas Show Fields of Natural Gas. Heavy Line Indicates One of Many Large Pipe Lines for Natural Gas



Typical of the Compactness and Cleanliness of Gas-fired Boilers for Fairly Large Houses



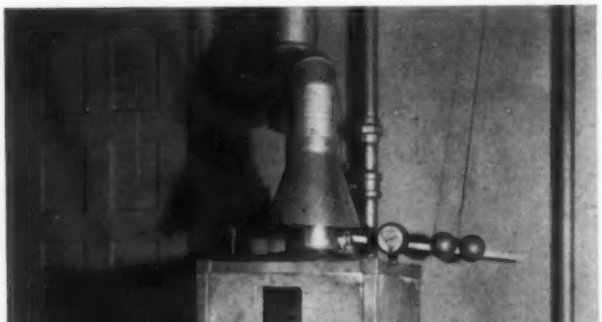
Cut Section Showing Construction of Boiler Designed for Gas or Oil. Copper Tube Elements Removable

essential factors have been definitely established. The nation-wide campaign for this market has only started within the present year, and the next ten years undoubtedly will see an enormous growth in the ranks of gas users.

Broadly speaking, there are two kinds of gas fuels and two methods of using either. Natural gas, used in the gas areas and in large population centers to which it is piped, contains from 1000 B.t.u. to 1100 B.t.u. per cubic foot, and sells for from 35 to 60 cents per 1000 cubic feet. Manufactured gas is fairly well standardized at 535 B.t.u. per cubic foot, and costs, as a domestic fuel, from 70 cents to $1. Thus it will be seen that the home owner who has natural gas available at the average cost, pays 50 cents per 1,000,000 B.t.u., in contrast to the user of manufactured gas, who has to pay, on the average, $1.50 for the same quantity of heat. Either kind of gas can be burned in a boiler or furnace designed and built especially for the purpose, or a special type of gas burner can be installed in any furnace or boiler designed for coal,—this latter being termed a "conversion" installation. Quite naturally, conversion installations originated in the natural-gas areas, in the early days, when this fuel sold approximately for "a quarter" per thousand. Efficiency was not thought of, and the wastage seems criminal. Even today, in some of these sections, gas street lights are used and allowed to burn all day,—it is cheaper than paying for the labor of lighting and extinguishing!

From the technical standpoint, there are three interesting features of the gas-fired boiler or furnace. Gas is a hydro-carbon, with a large proportion of its contents hydrogen in both free and combined states. The natural consequence of combustion is the combination of this hydrogen with oxygen to form water vapor, in volume about equal to the volume of the gas. Approximately 10 per cent of the heat energy in the gas is represented in this transformation, and this cannot be utilized unless the flue gases are cooled to their dew point,—about 130° Fahr. On account of the large amount of water formed by this condensation, it is usually desirable to keep the fine gases well above this temperature. Conventional combustion practice has been to mix the necessary air for combustion with the gas prior to initiating combustion, producing the characteristic blue flame of the Bunsen burner. Gas burned for illumination, on the other hand, is emitted from a small hole in a burner, and the flame is filled with minute particles of free carbon, heated to incandescence before the oxygen of the surrounding air has an opportunity to combine with it; it is the luminosity of these particles that gives to this flame its high emission of radiant heat. The Bunsen flame, however, produced by gas burners, emits but little *radiant* heat. As a consequence, in boilers and furnaces designed for gas firing, little or no attempt is made to absorb heat energy radiated by the flame; rather, there is provided a comparatively large amount of flue surfaces, with

Even a Small House, such as this, may be Heated Economically with Gas where Rates are Favorable



This Gas Boiler, in the Small House Illustrated, is about a Foot Square

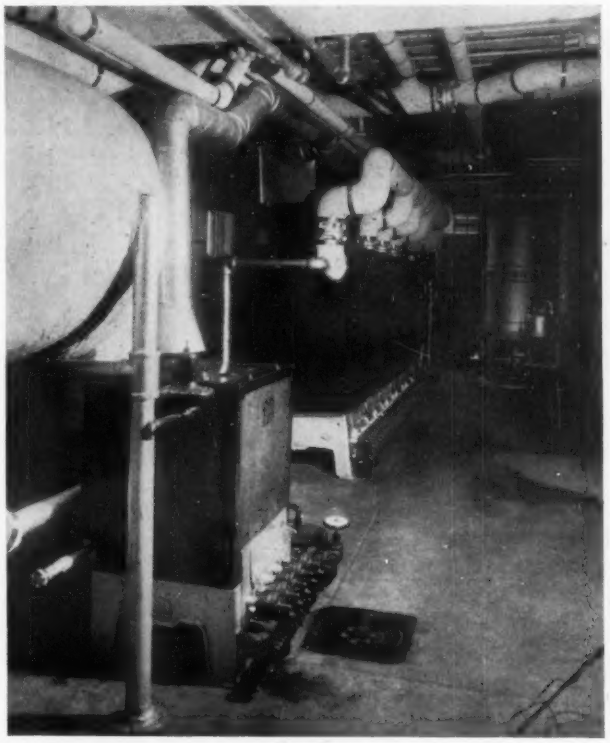
water on the opposite side in boilers and air in furnaces, for heat transfer from the hot products of combustion. It is this combustion characteristic that has dominated boiler design.

The third feature of the gas-fired boiler lies in the fact that combustion is best promoted when there is virtually no draft. Therefore, when a gas-fired boiler is attached to a chimney, a "draft-breaker" is inserted in the flue pipe, between the boiler and the chimney. This consists of a double-cone-shaped shell of sheet metal suspended in the axis of the smoke pipe, where a section of the pipe, 6 to 10 inches long, has been removed. A "skirt" is fixed to the upper part of the break. Hot gases flowing up the smoke pipe are carried around the double cone and up the chimney by virtue of the draft in the latter. Air is drawn in around the opening, nullifying the effect of the chimney pull on the boiler. If there should be a "back-draft," or downward movement in the chimney, it would be diverted by the cone and would pass out around the opening and not interfere with the functioning of the burner in the boiler. Thus a fixed draft, equal only to the flue action of the boiler itself, is maintained, regardless of fluctuations in the chimney due to combustion or to atmospheric effects. It is obvious that absolute and relatively high efficiencies can be maintained

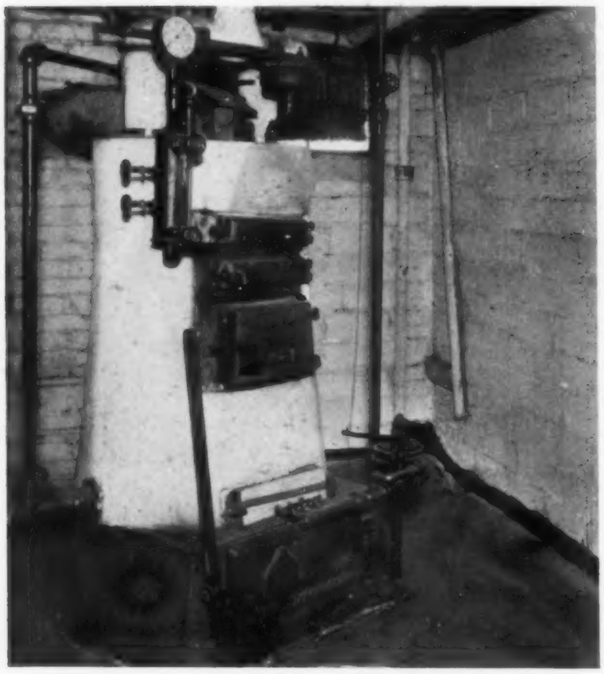
This Typical Large Residence where Winters are often Severe is Heated Advantageously by Gas-fired Boilers

where gas automatically is fired at a fixed fuel rate, with a non-fluctuating draft, and with all vital conditions controllable for optimum operation. A uniform seasonal operating efficiency of from 80 to 85 per cent is well within reason, as against from 60 to 65 per cent in an oil-fired boiler and from 35 to 50 per cent where coal is hand-fired. It is for this reason, chiefly, that comparatively high-cost fuel can be used universally, especially where insulation is installed, and other controlling factors in minimizing heat loss from the building are favorable.

Conversion installations are not looked upon with especial favor by gas companies where manufactured gas is to be burned, chiefly because of prejudice based on the woefully inefficient makeshift installations which were common years ago in the natural gas fields. In the New York area, for instance, it probably would be difficult to induce a gas company to make a service connection to such a plant. However, in Baltimore, hundreds of gas burners have been installed in boilers and furnaces with very satisfactory results, many of these having a record of ten or more years of service. The reason lies in the careful study that was made when the house-heating load was first considered. The technique was developed until these conversion installations, as now put in, are almost equal in efficiency to a plant using



The Heating Plant and Domestic Hot Water Plant of the Residence Illustrated



Boiler Originally Using Coal Now Converted for the Use of Gas Fuel

a specific gas-fired boiler. To secure satisfactory results when burning gas in a boiler designed originally for coal, it is necessary to simulate, as far as may be possible, the combustion characteristics of coal. To this end a ring-shaped burner is set on the grates, so that the flame is close to the walls of the combustion chamber. A barrel-shaped form of fire brick is then built up on the grate, almost to the top of the combustion chamber, leaving an annular space for the gas flame. The idea is to heat this mass of brick both by the limited radiation from the inside surface of the flame and by convection, so that the radiation from it will act on the walls of the combustion chamber in a way very like that of a bed of red hot coal. If a rectangular boiler is to be equipped to burn gas, the burner follows the walls, and the fire-brick form also is rectangular. The material increase in efficiency when this plan is carefully followed can easily be demonstrated by running a test before and after putting in the bricking.

Realizing the vast number of house-heating plants of the coal-burning type now in use, and the possibilities for conversion, much experimental work is being done along this line, and it is within reason to say that developments recently brought to a head will make possible conversion installations that will equal, if not surpass, the best gas-fired boilers now available. A boiler or furnace using gas as a domestic fuel can probably be brought as near to perfection, on an efficiency basis, as can any energy-transforming device, and on account of the enormous potential annual consumption, this phase of the matter is occupying the minds of many executives, engineers and research workers. Curiously, the absolute efficiency of a boiler is not an exact criterion of its usefulness in the home. For instance, in determining boiler efficiency the heat radiated from the boiler jacket is charged against the boiler as a loss. This is because it represents heat not available at the boiler outlet, in water or steam. At the same time this heat is manifestly useful, in that it warms the basement, especially the ceiling, which is under the living rooms. Cold floors are not desirable, so the heat marked up as wasted by the boiler does serve a useful purpose. By the same token, at least a portion of the heat in the flue gases is utilized in heating the house, particularly if the chimney is inside. It is only necessary to take the temperatures of the flue gas at the bottom and top of the chimney to determine the useful effect of this so-called waste heat. In a certain research study, where a warm-air furnace was used, the net efficiency of the furnace, as computed, was only slightly over 30 per cent. Yet the net heat lost to the house was less than 40 per cent, and the real efficiency of the heating plant, as rated by the heat actually utilized in the house, was more than twice the calculated furnace efficiency. Taking these things into account, it is not unlikely that gas heating can be accomplished with an efficiency above 90 per cent.

Much of the confusion that has grown up in regard to the rating of coal-fired boilers has, happily, been eliminated in the consideration of gas-fired units. The American Gas Association, realizing the

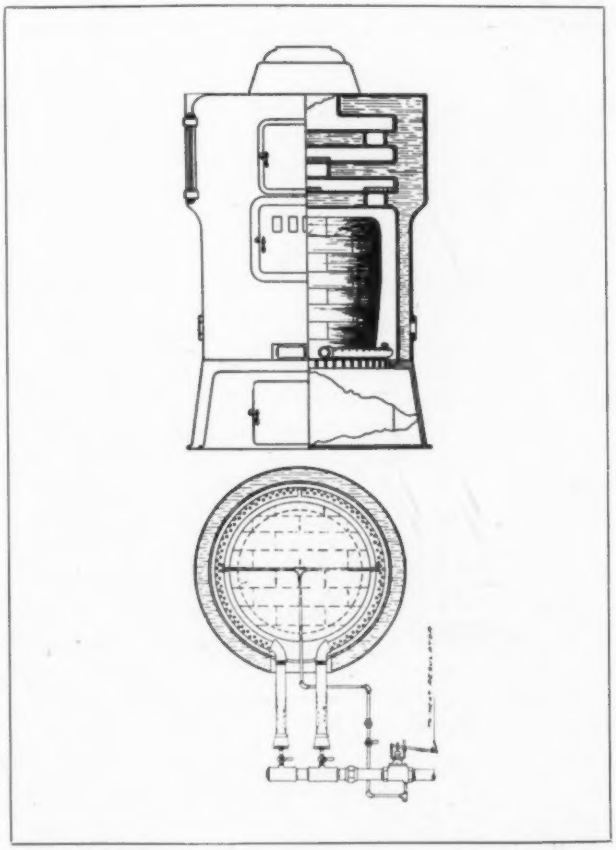
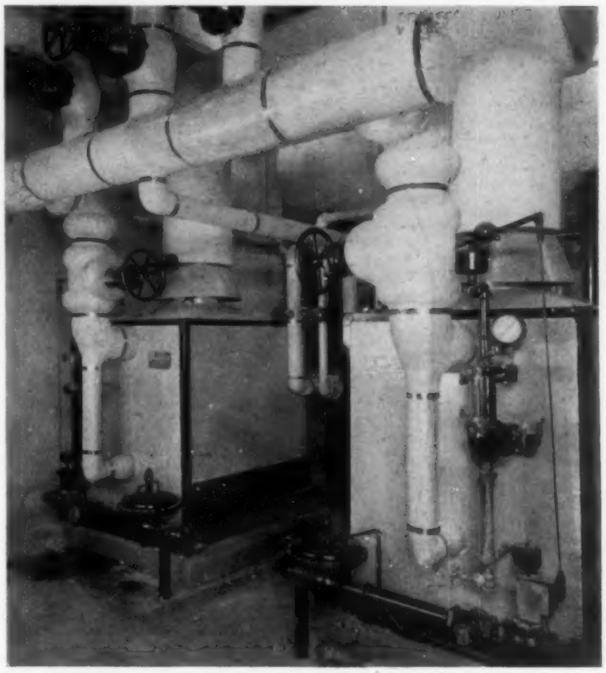


Diagram of a Typical "Conversion" Installation here Described

importance of logical and uniform capacity designations to those responsible for making rating recommendations and selection, as well as to owners, has brought about a logical and uniform scheme of rating, whereby products of manufacturers are tested in the Association's laboratory, and rated in B.t.u. available at the boiler outlet. This procedure removes one of the variables which the architect, heating engineer and contractor are least qualified to determine, and greatly simplifies the selection of a boiler for any purpose.

Two interesting considerations now make gas a desirable fuel for larger and better types of houses. Warm-air heating has, in the past, been used almost entirely for the smaller and cheaper houses, especially those built for speculative purposes. The everyday variety of warm-air installation admittedly has been "cheap,"—little more than a glorified stove with a tin can around it. Many furnace manufacturers were content with this class of market, and little progress was made in a half-century, so far as warm-air engineering was concerned. Less than four years ago leaders in that industry, and prime movers in the National Warm Air Heating and Ventilating Association, decided that some real engineering would be a good thing to stimulate development. So a research residence was built at Urbana, Ill., and since its completion it has been constantly in use as a field laboratory, under the direction of Professor



A Large Gas-fired Boiler Installation Using Two Boilers for Flexibility

A. C. Willard, of the University of Illinois, assisted by a notable staff of research engineers. Professor Willard has turned out to be the modern Moses of this industry, and more real progress has resulted from the efforts of the director and his staff in three years than was made in the quarter-century preceding. For another influence of vital importance to the development of gas heating we must look to the electric refrigerator, the washing machine and the oil burner. Each of these devices utilizes a small electric motor, usually from 1/10 to 1/4 horse power.

With these two thoughts in mind, let us turn back to a consideration of the possibilities of the gas-fired warm-air furnace. In the first place, warm air is an ideal heating medium because, where it is used directly, and not with steam or water as an interposed medium, it can be properly humidified,—and it is definitely established that proper humidity is an essential to optimum comfort. Not only that, but the proper humidity will keep furniture together for many years, whereas, in a dry atmosphere, it will quickly fall apart. On the other hand warm air, as it has been used in the past, was not a satisfactory heating medium, for the simple reason that its movement to the rooms of a house was dependent upon the natural rise of warm air and the tendency of cold air to settle; such plants were called "gravity" systems. The trouble was that, against infiltration from a cold winter wind, the warm air would not rise to the rooms on the windward side of the house; these rooms "never could be heated." So the desirable features of warm air were more than nullified by the fact that it wouldn't go where it was wanted. Enter, then, the idea of using a little fractional horse-power motor. The motor has been proved

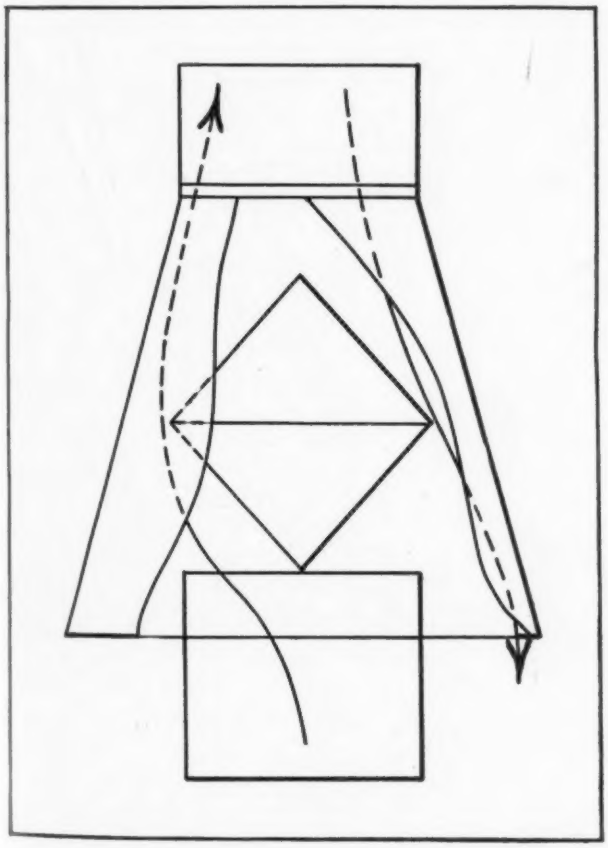
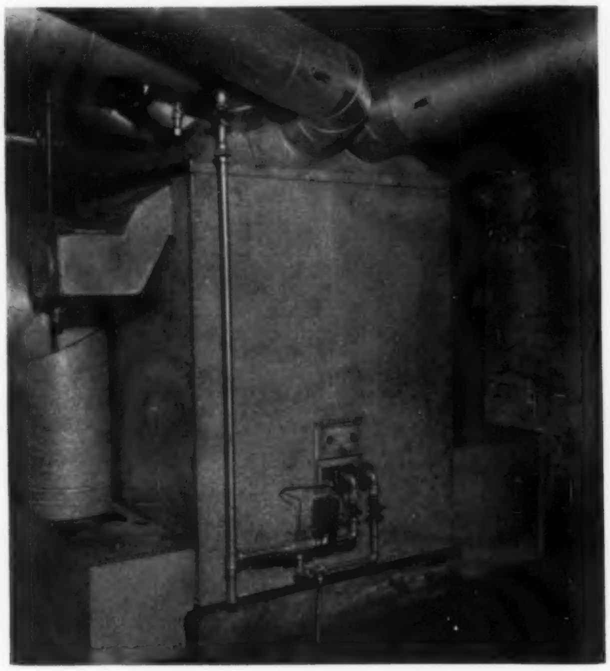


Diagram of the "Draft Breaker" Described on Page 586



Gas-fired Warm Air Furnace, Showing a Type Frequently Installed on the Pacific Coast

Warm Air Furnace "Conversion" Installation of a Type often used when Natural Gas is Available

reliable by the washing machine, the refrigerator and the oil burner. It would run six to ten or 12 hours a day for an insignificant sum. What could be more simple than to place a fan in the supply duct of the furnace, and to force the flow of air, regardless of infiltration or whatnot? This scheme has been so far developed that residences having as many as 20 rooms and 24 registers have been well heated in the coldest sections of the country. In other words, the market of today for warm-air furnaces is not limited to small houses nor to homes of low cost.

Now introduce gas as the fuel to be burned in one of these modern warm-air furnaces with positive air circulation. This fuel is delivered into the house only as used; considered in this way, it has no appreciable weight. The gas-fired furnace can be built extremely light in weight. It does not, as does the coal-fired boiler, require a 30-foot to 50-foot chimney. Rather, it wants a zero draft. Why should we not, in view of these figurative fingers all pointing the same way, put the gas-fired warm-air heating plant in the attic where it will occupy practically waste space, eliminating the basement altogether, or making it a considerable addition to the livable portion of the house? The objection that "warm air will not flow downward" is silenced by the positive delivery of warm air, by the blower, to any part of the house, up or down. In the summer time a gas-fired refrigerator can be utilized to cool the air that is being circulated through the house. The entire conception is simple, although somewhat striking, merely because it hasn't yet been done.

This, perhaps, is the ultimate in gas "heating." It is not a "pipe dream," because the essentials have been conceived and put into practice by one of the foremost engineers specializing in the field of conditioned air. For over a year nearly a hundred "unit air-conditioning plants" have been in operation in as many homes. The unit for a ten-room house is little larger than an office desk. It is gas-fired, automatically controlled as to heat supply, provides a definite circulation of air that is humidified to just the proper degree, and, in the summer, provides the house with cooled air, dehumidified.

The more general use of gas as a fuel for domestic heating may depend to some extent on the increase in the amount of gas devoted to this use which, in turn, may bring about a lowered price which will enable the owner of a modest home, located within a reasonable range of centers of population, to heat his house with gas economically and automatically.

NEW TREATMENT OF MONOLITHIC EXTERIORS

BY

JOSEPH B. MASON

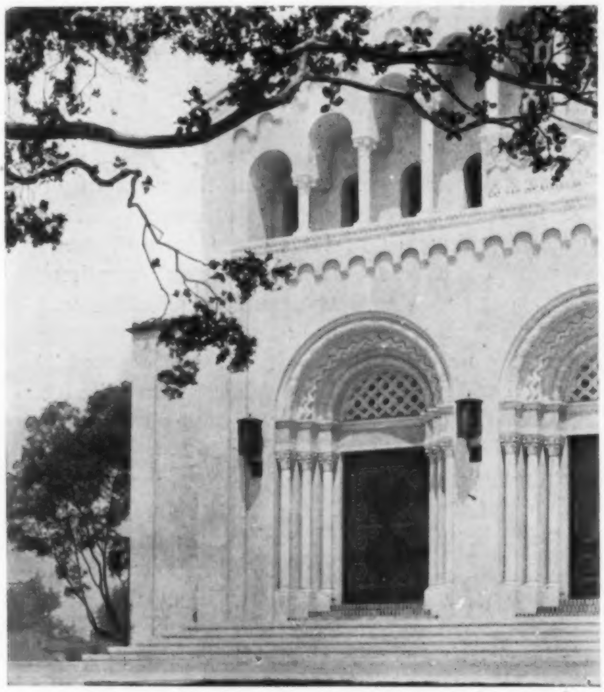
A SURPRISING number of somewhat imposing buildings, including a representative allotment of churches, theaters, lodge buildings, court houses and other public and semi-public structures, have been designed within the last two years in what, for lack of a better term, has been called the "monolithic" style. Possibly it would be more illuminating to say that they have been designed as monolithic structures in which both the architectural and structural requirements have been met with concrete. In these buildings the columns, floors and walls are cast as a unit, the forms being built so as to include practically all of the architectural details and trim as the work progresses. Such buildings are characterized by solid walls, clean cut lines, tall pilasters which carry the eye from the ground to the sky-line, and interesting relief work, which for the most part is cast in place. They have colorful exteriors, achieved through use of stucco and through varied methods of surface treatment of the concrete walls and columns. A technique has been developed to secure attractive surfaces in the monolithic concrete which warrants especial attention. Whether we approve of the design or not, we cannot help feeling keen interest in the new methods employed.

In reinforced concrete the architect has a medium which flows and may be moulded, and through which form appears in gracefully unfolding stages until the final mass stands revealed. The nature of the work demands special care in concrete mixing, since concrete serves as both the structural and facing material. The fact that the concrete is to be exposed to the elements makes it important that unusual care and attention be paid in making and placing it. Contractors should bid on the concrete at a price that will permit this especially careful attention. It is apparent that the old time 1:2:4 concrete mix does not possess the qualities necessary for all this class of work. No rigid mix can wisely be used for many different purposes. The fact that better concrete and concrete that can be adapted to given purposes is being made has had much to do with the development of the monolithic type. Today architects and engineers may demand and obtain concrete that will fulfill their requirements, both structural and architectural, with assurance that it will withstand the elements at least as successfully as any other material to be had within the economic limit of his design. Intelligent and constructive research has checked and re-checked theories of concrete design so thoroughly that concrete can now be made to a definite specification.

Concrete for the exposed walls and columns of the monolithic structure must be of a uniform composition throughout the entire exposed area. Size and grating of the fine and course aggregates should be consistent throughout, so that the class of concrete may be uniform. A water-cement ratio of 6 to 6½ gallons of water to one sack of cement will produce concrete that will resist weathering and prevent the obsorbing of moisture in the walls. Consistency and workability are very important qualities, which must be watched. Concrete should be of such a consistency that it will go into all of the corners of the forms without excessive spading. On the other hand, the mix should not be so wet that after the concrete has been in the forms for 10 or 15 minutes water will rise to the surface. Too liquid a mix will cause the cement paste to work to the surface of the forms, so that when the concrete is exposed, a fatty face with an unpleasant, almost polished, surface of pure cement results. Each batch of concrete should have the aggregate and water measured very carefully, so that the density of every batch will be the same.

In the forming of mouldings, projecting bands, recesses, fluting, etc., it must be constantly borne in mind that everything must be designed for the perfect flow of material. It is important that the concrete be evenly distributed along the form so as not to flow by gravity from the point of discharge to any far point in the wall. The forms should be filled evenly and the concrete, where possible, placed in one continuous operation. Any break in the placing should be made at definite lines along the bottoms of window openings. Inequality of surface and elimination of form markings are not desirable.

In the order of present popularity, the principal methods of treating the concrete exteriors of monolithic buildings are: *first,* stucco; *second,* surfaces with exposed form marks; *third,* grinding and rubbing; *fourth,* special applied finishes. I shall take these up in this order. Stucco exteriors in pure whites, creams and varied colors have been used with success not only on the Pacific coast, where this method of treatment has been widely practiced, but also in other parts of the country. In order to secure a firm bond between the stucco and the monolithic surface, all dirt, grease, oil or other similar matter must be removed. When two- or three-coat stuccoes are employed, it is usually advisable to roughen the surfaces of the concrete before application. This may be done most easily by brushing the surface with wire brushes before the concrete has fully hardened. A special preparation is now obtainable which may be spread on the interior surfaces of forms and which will retard the hardening of the cement mortar at the surface. It may then be easily roughened by brushing. A good bond is also dependent upon good suction. A concrete



Portland Cement Plaster on Monolithic Walls. Doorway Ornament of Pre-cast Stone
John Galen Howard & Associates, Architects

saturated with water will have practically no suction; pure or dry concrete will probably have too much.

A single coat of stucco which improves the coarse appearance of the surface of the concrete but which does not completely obscure the form marks is used very often and with considerable success. A mixture made in the proportion of 1 cubic foot of Portland cement to 2 cubic feet of sand has proved very satisfactory when just sufficient water has been added to make a mortar of creamy consistency. This mixture is dashed on the concrete surface with a stiff brush and allowed to harden without troweling. Two- and three-coat stuccoes are used to achieve surface effect beyond the possibilities of the single-coat. Various trowel effects are possible, or the exterior stucco coat may be marked off in the pattern of stones. Some of the most unique effects have been achieved by combing stuccoed surfaces with a stiff wire brush. An interesting effect is obtained by combing alternate blocks at right angles to the horizontal. Commercial Portland cement stuccoes containing, where color is used, thoroughly tested mineral pigment, are recommended. The colors of stuccoes can be controlled very closely.

Probably the most interesting, because of the boldness of the experiment, has been the practice of leaving the monolithic surfaces just as they come from the forms, with no further surface treatment. Without entering into the merits of this procedure, it is sufficient to say that it has been used to produce a number of striking and interesting structures and is worthy of consideration. Surfaces that are to be left as they come from the forms must of course be detailed carefully. Good quality lumber and boards of uniform width, well finished, must be specified for the forms. Careful study should be made to determine the proper widths of form boards to be used. Wide boards tend to make the

Monolithic Concrete with Cast Stone and Colored Stucco Exterior
George Applegarth, Architect

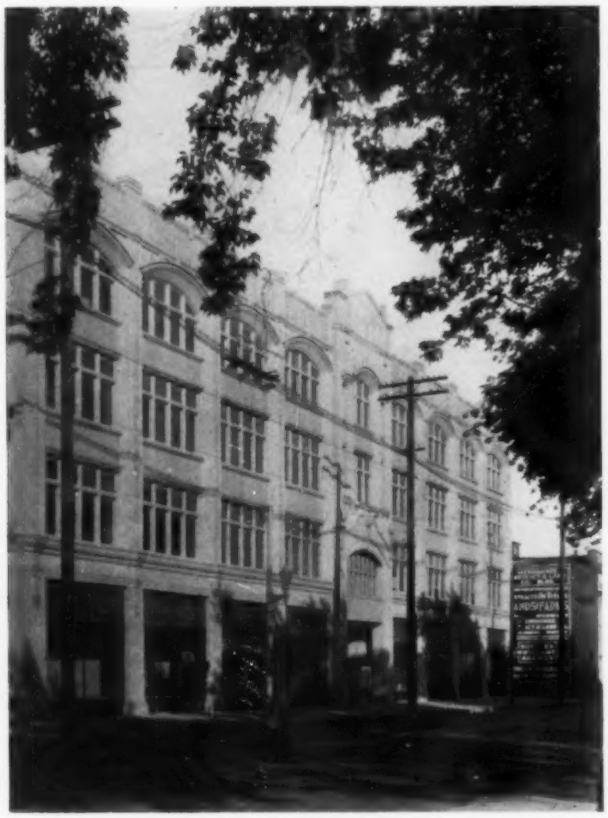
structure look heavy and clumsy, while narrow boards warp the design. The form boards must be leveled and carried entirely around the building at the proper elevation, and joints should be so broken that they will not be conspicuous.

Some surface treatment with a portable grinding outfit or carborundum wheel is often made. The grinding should not remove all of the form marks, but should merely even the surface, giving it a more pleasing appearance without destroying the textural effect. The extent to which grinding or rubbing of the hardened concrete surface is carried forward will depend upon the effect desired. Many structures which have proved very attractive received only slight rubbing with a carborundum stone after application of a cement wash. Again, to achieve the desired effect, more intensive rubbing or grinding of the entire surface is often carried out. Bush hammering and other air-tooling treatments of concrete surfaces are in general use over panels and small border areas. Concrete of good quality may be tooled with success, and this provides an interesting variation in the surface treatment. Exposed aggregate surfaces offer interesting possibilities. A surface material made up of specially colored aggregates is applied either as stucco or by casting and applying to the surface of the wall. After this facing material has been applied and allowed to harden, the aggregates are exposed by washing with diluted muriatic acid. This method produces concrete that is very hard and durable and yet permits the carrying out of even the most minute details.

Monolithic Concrete with Rough Concrete Finish
F. Pierpont & Walter S. Davis, Architects

One of the advantages of using the monolithic concrete type is that decorations or embellishments can be cast as integral parts of the walls. Reverse plaster or wooden moulds are built into the forms as they are erected, and are filled with the concrete that is used in the rest of the structure.

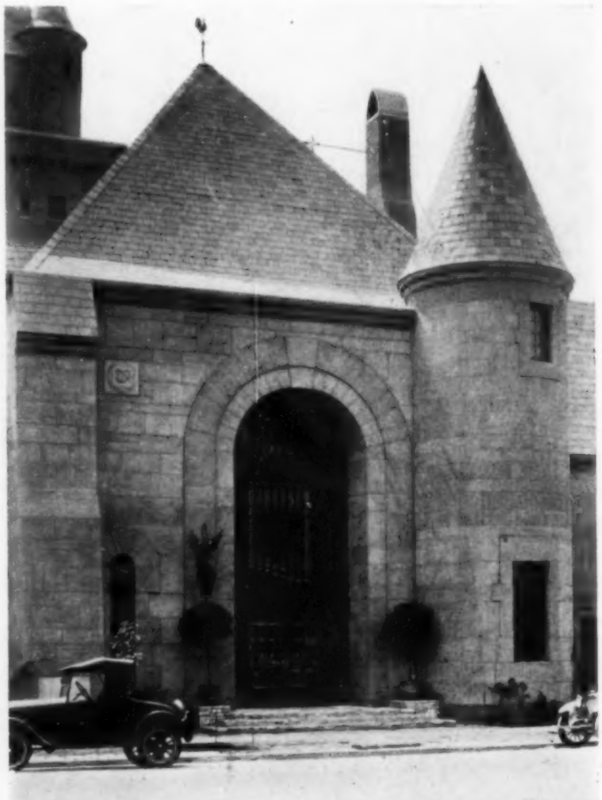
Reinforced Concrete Walls with Light Buff Stucco Exterior
Bertram Grosvenor Goodhue, Architect; Carleton Monroe Winslow, Associated



Monolithic Concrete with White Portland Cement Stucco Exterior
Derrick Hubert, Architect

Portland Cement Stucco and Cast Stone Trim and Ornament
L. L. Dongan, Architect

Brush Coat of Cream Colored Stucco Trimmed with Cast Stone and Sgraffito
Allison & Allison, Architects



Light Chocolate Colored Stucco Exterior over Reinforced Concrete
Curlett & Beelman, Architects

ARCHITECTURAL USE OF LIME

BY

J. J. HURLEY

CONSTRUCTION ENGINEER

IT is well known that modern structures require lime in some form or another, and for certain purposes for which no other material is "just as good." Lime putty is probably the "stickiest" and "slipperiest" cementitious material known. For this reason lime putty sticks where it it put, and as many would say, "it puts very easily." Every variety of lime has its architectural use, but the number of kinds of lime that may be used for each architectural purpose is very small.

First of all, just what *is* lime? It is the product obtained by heating limestone to its dissociation temperature (1600° to 2100° Fahr.) under such conditions that the carbon dioxide and other volatile matter are expelled. Lime consists primarily of calcium oxide, but may contain magnesium oxide, which in some limes may range in amounts as high as 45 per cent. Small amounts of alumina, ferric oxide and silica, and traces of other impurities are frequently present. The suitability of lime for any particular use depends on its chemical composition and its physical properties. It is here that the architect is forced to depend on established and reputable lime manufacturers to guide him in specifying the kind of lime for the purpose in mind.

History. Lime was probably the first cementitious binder used by man. The technique and practice of its use have been developed by centuries of experiment and observation. The fact that many architectural gems have come down to us from ancient days, and that they have resisted the ravages of the elements for centuries, bears eloquent testimony to lime's lasting qualities and integrity. Lime was first used because of the fact that it hardens from a soft, smooth, easily handled paste into a dense, hard mass. Brick, stone or other building units laid in it are bound together into monolithic, durable structures. The structural details and natural roughness of the construction units can be masked by spreading lime mortar over them in the form of plaster, thus giving a pleasing and hygienic surface.

Any lime manufacturer of recognized standing can be depended upon not to recommend the lime he makes to be used for a purpose for which it is not suitable. It is especially important that the instructions issued by the manufacturer regarding the slaking of the lime he manufactures be followed and emphasized by the architect in his specifications. With some lime it is necessary in slaking it *to pour the water on the lime.* With other lime, of different chemical and physical composition, it is necessary *to put the water in the box and to dump the lime into the water.* All of this is necessary in order to obtain the best results, and it is obvious that the architect cannot be expected to know these things unless he has had long experience with the particular brands of lime used in any special given instance.

Specifications. Unless it is wished to confine the kind of brand of lime used to one special make, it is suggested that these short specifications be used: "The lime (quicklime or hydrated lime) shall meet the current standard specifications of the American Society for Testing Materials and shall be used in accordance with the manufacturer's printed instructions. The brand of lime shall be approved by the architect." Modern methods have been applied to the manufacture of lime by the more progressive lime manufacturers. They have been quick to make use of the valuable research work done by the United States Bureau of Standards. The Bureau is the authority for the statement "that any good lump lime pulverized and passed through a 50-mesh screen *can be guaranteed not to pit or pop.*" This is the reason why at least one of the largest lime manufacturers in the country advertises that one of his brands is *"guaranteed not to pit"* when used for plastering. Pulverized lime has many advantages for the architect, when guaranteed by a reputable manufacturer. When made as directed by the United States Bureau of Standards, the architect does not have to wait for the lime putty to age for from two to eight weeks, as is necessary with lump quicklime putty, or hydrated lime. Putty made from pulverized quicklime so manufactured may be used with perfect safety as soon as it is cold.

The modern manufacturing process of making lime is in accord with exact chemical science in which experienced chemists are regularly employed, and in which mechanical engineers, civil engineers, and geologists are also on the regular payrolls. The modern lime plant is a most interesting place. Everywhere one sees motors, conveyors made of steel pans for handling hot lime, labor-saving devices of all kinds, electrical recording pyrometers for keeping track of the heat of the kilns; modern automatic gas producers; automatic coal-handling machinery for handling coal from cars or barges; barrel plants where wood barrels are turned out complete, almost without human hands touching them; electrical, steam, and gasolene locomotives and all-steel cars for hauling both limerock and the finished product to where they are needed,—and in fact all of the up-to-the-minute appliances of big business.

Hydrated Lime. This lime is a very important architectural material, and it is demanding its increasing place in the architect's mind. Hydrated lime is quicklime with its chemical appetite for water satisfied. It is produced in this way. The lump quicklime to be hydrated is crushed, and then conveyed mechanically to the machine known as the "hydrator." This supplies the quicklime with the proper amount of water to convert it into hydrated

Portion of a Large Lime Quarry

lime of the required chemical and physical properties. Three types of hydrators are used, differing in detail, but all providing for mechanically mixing the quicklime with the necessary water and for conserving the heat of the chemical reaction in sufficient degree to effectively hydrate the quicklime without "burning." The hydrated lime is discharged from the hydrator as a dry white powder. The modern mill uses air-separation units, conveying machinery where air currents carry the hydrated lime to the bins, devices which measure exactly the predetermined amount of water for every pound of quicklime, and last but not least, careful laboratory tests of every batch so as to be sure that the hydrated lime meets the current standard specifications of the American Society for Testing Materials before it is shipped. Hydrated lime and pulverized quicklime are the lime manufacturers' answer to the incessant modern demand for speed.

Kinds of Lime and Hydrated Lime. The "trade," meaning manufacturers, dealers, masons and plasterers, divide lime into these classes:

(1) Common or masons' lime (quicklime), which is usually lump lime, but may be pulverized, and is run-of-kiln lime without any selection. This is the type of lime that is generally used for masonry of a less important nature, bearing light loads, for rough plastering, and for stucco work.

(2) Finishing lime (quicklime) is the best selected lump or pulverized lime made by the manufacturer. It contains a minimum of core and other foreign matter, and is used for the best class of masonry, all grades of plastering, and stucco work. It is more plastic than common lime.

(3) Masons' hydrated lime may be used for scratch and brown coat plastering, for stucco, for masonry mortars, and as an admixture to Portland cement concrete.

(4) Finishing hydrated lime may be used for any purpose for which masons' hydrated lime may be used, and in addition, it may be used as an ingredient for the final or white coat of plaster. Finishing hydrated lime will have a plasticity figure of 200 or more on the Emley plasticmeter, all as outlined in the American Society for Testing Materials Tentative Methods of Sampling, Inspection, Packing and Marking of Lime Products. The Federal Specifications Board has Master Specifications covering lime of all kinds, both quicklime and hydrated lime, which are essentially the same as the "Standards" published by the American Society for Testing Materials. There are 38 varieties of limestone listed by Knibbs, which run from alabaster, through chalk and marble to travertine. Marble is perhaps the purest high calcium limestone that we know today.

Modern Stucco. The architect is much interested today in stucco. The economy of its construction, its durability of surface, fire resistance, low maintenance cost, its use in improvement and repair of unsightly or old surfaces, and the pleasing artistic effects possible with stucco, all find favor with the architect, and with his client as well. The term "stucco," which was formerly used in referring to ornamental plasterwork, whether interior or exterior, is now confined to exterior plastering, either plain or ornamental. Stucco may be defined as a material used in a plastic state to form a hard coating for exterior walls or surfaces. Stucco is a mixture of one or more cementitious materials with sand or other fillers, and with or without other materials such as hair, fiber and coloring matter. Lime stucco is a mixture of properly prepared lime putty or paste, sand and water, with or without the addition of a small percentage of cement. Hair or fiber may be added to assist in forming the "key," depending on the style and character of the background. Coloring matter may be added to obtain the desired tone, although most satisfactory color effects are obtained through the use of selected sands. Different colored (fine or coarse) aggregates may be used for obtaining various effects of colors and surface textures. There are many fine examples of the architectural use of lime stucco in the older states, both of New England and the South, especially in Charleston, S. C., and the missions of California. New Orleans must also be mentioned, as the French influence is most noticeable in the stucco on homes and churches in that fine old city. The economy of lime stucco is due to a number of factors. The ability of lime putty to carry a large amount of sand makes possible a leaner mix, which authorities agree is the best in

stucco work. The high plasticity enables the plasterer to apply lime stucco easily, to spread it with little effort, and to work it thoroughly. Freedom from cracks is one of the special merits of lime stucco. A. H. White, an authority on stucco, says: "Freedom from initial hair cracks can be secured only by using a lean mixture, not richer that 1 part of cementing material to 3 parts of sand by volume." The manner in which lime stucco hardens prevents the formation of cracks. It hardens slowly enough, due to evaporation of the water and recarbonation of the lime, to permit the lath to which it is applied to adjust itself. Where other backing, such as masonry, is used, there is no movement. While the freshly applied stucco expands and contracts with moisture changes, the fully hardened stucco shows little change, since it will consist of porous bodies in greater or less degree. Waterproofing is unnecessary in properly proportioned, mixed and applied lime stucco. Stucco will absorb in rainy weather,—but this is not injurious. The density of lime stucco corresponds closely with mortar used for masonry.

Plastering. Plastering involves perhaps the most important architectural use of lime. It is used to shut out drafts, to make for more privacy, and to make dwellings and other structures more sanitary and beautiful. It also affords some protection against fire. There are two kinds of plastering,—good and bad. As everybody seems to be talking about *good* plastering, it seems to be in order to discuss *bad* plastering,—at least some of its most glaring faults.

Plaster Cracks. In a long and varied experience in a number of states, the writer has seldom heard anyone suggest that the lath or structure itself might be responsible for the cracks, although in over 90 per cent of the cases investigated where severe cracking has been the cause of the complaint, the defects of the structure have been the real reason for the trouble. It must not be supposed that lime plaster does not have defects and cracks which are the fault of the plaster or the way the plaster is applied, for it does. There are map cracks, shrinkage cracks, check cracks, fire cracks, and crazing. There are also the "pitting" and "popping" that, despite the best efforts of the manufacturers and all other persons interested in plastering, will put in their appearance occasionally when unguaranteed lime in lump form is used. All of the defects that can be charged to the plaster can be dismissed from the mind of the architect if a reliable, well established, and experienced plastering contractor does the work, and if a lime that is guaranteed by the manufacturer not to pit or pop is used.

Efflorescence. This defect, sometimes called "blotches," is most difficult to avoid. Sometimes areas of considerable size have the appearance of being wet. They dry out after a while, but they come back intermittently over a long period of time. These blotches are caused by certain salts which are soluble and hygroscopic. As the mixing water evaporates, these salts are brought to the surface and

A Modern Vertical Lime Kiln

deposited. Their hygroscopic property causes them to absorb water from the air, thus keeping the plaster damp. Calcium chloride is one of these salts, and this substance is readily formed by interaction between lime and common salt. This is one reason why sea water or beach sand should not be used for plastering. This is also a reason for not using calcium chloride in the mortar for plastering to reduce the danger of freezing.

The peeling or blistering of paint is almost always due to the presence of water in the plaster. If plaster is painted before it is absolutely dry, trouble may be expected. *Lime or any other type of plaster should not be painted in less than three months from the time the finished plaster is applied, and then only if the plaster is dry.* Paint sometimes "burns" when applied over plaster. Free lime, oxide or hydroxide, will destroy linseed oil, causing the paint film to become brittle. One may expect to find free lime in all green (damp, or wet, newly applied) plasters, whether they be lime, gypsum or cement. If it is not desirable to wait for the free lime to become inert through carbonation, a priming coat may be used. This coat should be prepared by dissolving three pounds of zinc sulphate in a gallon of water. The zinc sulphate reacts with the lime to produce compounds which have no effect on oil. Cold water paint may be used without taking this precaution. All architects want good plastering, because plaster is about two-thirds of the area visible in the usual

room. The plaster should make and continue to give a good impression over a long term of years. This is not possible if the architect permits, for any reason, inferior work. One-coat plaster work is to be especially condemned.

Two-coat Plaster. Two-coat lime plaster on wood or metal lath, when properly done, will give satisfaction. This is especially true if the under coat is put on in two parts and brought out to grounds and well darbied and straightened, and then floated down properly with a wooden float after the plaster has stiffened, but before it is dry. This floating operation is very important, for it fills up all the shrinkage cracks and leaves a mechanically roughened surface for the finish or "skim" coat. The so-called "Boston skim coat," when applied by an experienced plasterer, is a most satisfactory finish over doubled-up, two-coat lime plaster. Boston skim is made of clean, sharp sand and lime putty in about equal parts and troweled to a smooth, hard surface.

Three-coat Work. This represents the proper use of lime plaster, the first or scratch coat being applied and allowed to become absolutely dry before the second or brown boat is applied. The brown coat is also allowed to dry before the finish coat is applied. All this is true, no matter to what kind of lath or masonry backing the plaster is applied. Plastering often seems to be a good detail on which to save money in cutting the cost of a structure, but for the architect's peace of mind, it would be much better to save on some other item, for nothing comes under the observation of owners and tenants quite as constantly as plaster.

The American Institute of Architects in collaboration with the National Lime Association has prepared standard specifications for lime plaster, copies of which can be had by an architect if he will apply to any lime manufacturer, or to the National Lime Association, at Washington. The United States Bureau of Standards is responsible for the statement that in the presence of moisture (and all plaster is subject to exposure to moisture at one time or another), lime plaster preserves metal lath from rusting. This is so because lime has an alkaline reaction. On the other hand, there are some so-called "patent plasters" to be had that have an acid reaction.

Mortar for Brick and Other Masonry. The function of mortar in laying up brick, stone, tile, etc., is twofold. It must provide a smooth bed upon which the building units may be easily laid, and it

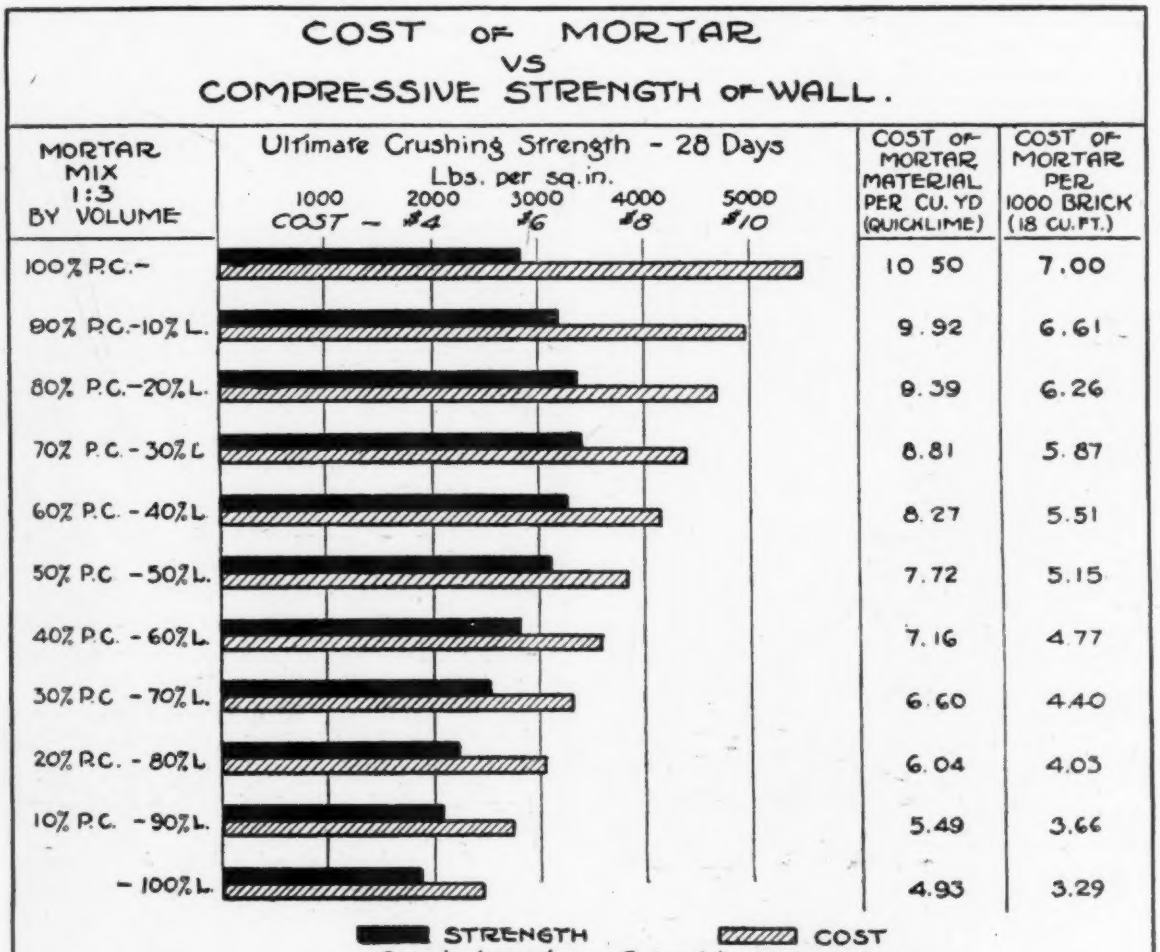
A Modern Horizontal Revolving Drum Lime Burning Kiln

must bind them together into a permanent mass. From the architect's point of view, it is necessary, in addition, to prevent the entrance of rain, wind, and cold through the spaces between the building units, which must be entirely filled with mortar. It is necessary that the mortar develop a safe compressive strength to resist the load on the lowest mortar bed, and also develop sufficient cohesive and adhesive strength to properly hold the building units in their places while the mortar is attaining its initial strength. The mortar must also finally pass the tests of durability and density. In all these qualities lime mortar or "1:1:6" mortar (made of 1 part by volume of Portland cement, 1 part by volume of lime putty, and 6 parts by volume of sand) properly used, meets the requirements.

Strength of Lime Mortar. The tests of Prof. McGregor, at Columbia University, will serve as an illustration of the strength of varying mixes of mortar from straight Portland cement to straight lime for the cementitious portion and 3 parts of sand, by volume. The graph included here tells the story, and while the cost figures given do not pretend to be accurate for all portions of the country, they are relatively correct, as a substitution of local prices will show. It will be noted in this graph that the greatest compressive strength is obtained by using 70 per cent of Portland cement and 30 per cent of lime putty. The graph also shows that 50 per cent of Portland cement and 50 per cent of lime putty give almost as great strength as the strongest combination shown; that is, that it gives well over 3,000 pounds per square inch.

Costs. It is impossible to give actual costs on mortar for the whole country, but it is easy to point out that lime putty is the cheapest per cubic foot of any cementitious material used for mortar.

Watertight concrete is concrete through which water cannot pass. "Waterproofed" concrete is concrete to the surface of which some treatment has been applied which may or may not prove permanent, to prevent the entrance of water. Hydrated lime is used in making concrete more "watertight." Because quicklime must be made into putty before it can be used in concrete, and because lime putty does not lend itself well to easily mixing with dry Portland cement, sand and other aggregate, hydrated lime is today universally used and is recommended.



Graph based on Columbia University Test Data (MacGregor)

SIMPLIFIED PRACTICE ACHIEVEMENTS IN THE BUILDING AND CONTRUCTION FIELD

BY

RAY M. HUDSON

ASSISTANT DIRECTOR COMMERCIAL STANDARDS GROUP, BUREAU OF STANDARDS

THE high standards of living enjoyed by the American people are the results of steadily mounting *per capita* productivity. Further advances in these standards must be brought about by improving methods and processes, through the elimination of waste in materials and motion in our production and distribution system. Just as 20 years ago we undertook nation-wide conservation of our natural resources, so today we must even more vigorously sustain this campaign for a better utilization of our industrial resources and effort. Wastes in commerce and industry fall into a number of classes. While they are of immediate importance to manufacturing concerns, the business community, and construction engineers, the interests of the general public are involved to an important degree.

In 1921, when the "Hoover Committee on the Elimination of Waste in Industry," made a survey of conditions in six of our major industries, it found that the building industry stood in fourth place, with 53 per cent waste. Thirty-four per cent was chargeable to management. One of the major causes was lack of simplification and standardization in materials, methods, machinery, and so on. When it is remembered that five billion dollars are spent annually in construction, some conception may be gained of the extent to which this loss reduces the country's income. Manufacturers and business men are forced to look into their businesses more intensively than ever before for opportunities to cut down costs and yet maintain for themselves a fair profit. They are finding that a prolific source of waste is using too much variety. A surprising proportion of this variety is made up of slight dimensional differences, of models and types which are not markedly dissimilar, but which were originated in an effort to be "just a little different."

The Department of Commerce, through the Division of Simplified Practice, is assisting the building and construction industry to check this waste, through the reduction of unnecessary variety in sizes and dimensions and other immaterial differences in everyday commodities. This coöperation on the part of the government involves nothing regulatory nor inquisitorial. The service is to help such industrial groups as are interested in reducing waste to get the *facts* as to waste and to put their corrective actions into practice. Safeguards have been set up to protect the fullest development of individual initiative and inventon, as well as to care for the changing trends of business. This is done by providing that the simplified practice recommendations, developed under the auspices of the Division of Simplified Practice, shall be subject to review at the end of such a period as may be fixed by the industry. The re-survey is conducted by a standing committee representative of all factors in the industry, or through another general conference of producers, distributors and organized users. Acceptance by manufacturers, distributors and organized users, representing 80 per cent of the total volume of the industry, is necessary before a program can be published as part of the Elimination of Waste series of the Department of Commerce.

These percentages of reduction in variety have been startling, especially in the application of simplified practice in the building and construction field:

Simplified Practice Report	Items	Reductions From–	To–	Percentage
1	Vitrified Paving Brick	66	5	92
3	Metal Lath	125	24	81
7	Rough and Smooth Face Brick	75	2	97
	Common Brick	44	1	98
8	Range Boilers	130	13	90
12	Hollow Building Tile	36	20	44
13	Structural Slates for Plumbing and Sanitary Purposes	827	138	83
14	Roofing Slates (descriptive terms, thickness and sizes)	98	48	51
16	Lumber — Standard Nomenclature Grades and Sizes for Softwood Lumber			
18	Builders' Hardware (items;	6948	5130	26
	finishes)	100	29	71
21	Brass Lavatory and Sink Traps	1114	76	93
25	Hot Water Storage Tanks	120	14	88
26	Steel Reinforcing Bars; Cross-sectional Areas	32	11	66
28	Sheet Steel	1819	261	85
29	Eaves Trough and Conductor Pipe	21	16	24
32	Concrete Building Units (length, width and height of blocks, tile, and brick)	115	14	88
38	Sand Lime Brick (length; width; height)	14	3	79
43	Paint and Varnish Brushes	480	143	70

Certainly a major contribution to the stability and prosperity of American business is reflected in the savings which industry has gained from simplification. Industrial leaders estimate that these amount in value to more than $500,000,000 a year.

Elimination of 60 per cent of variety in sizes of softwood yard lumber is estimated to have reduced extent of inventories formerly carried by four billion board-feet, thus releasing some $200,000,000 of relatively idle capital. Strict adherence to this lumber simplification assures the home builders of the country the production and distribution of standard dimension lumber supported by the united interests of the industry. During the past year, the lumber simplification program was given even greater impetus through the development of grade marking for cut lumber, on the part of many companies.

FIRE RESISTANCE OF BUILDING MATERIALS AND CONSTRUCTION

BY

S. H. INGBERG

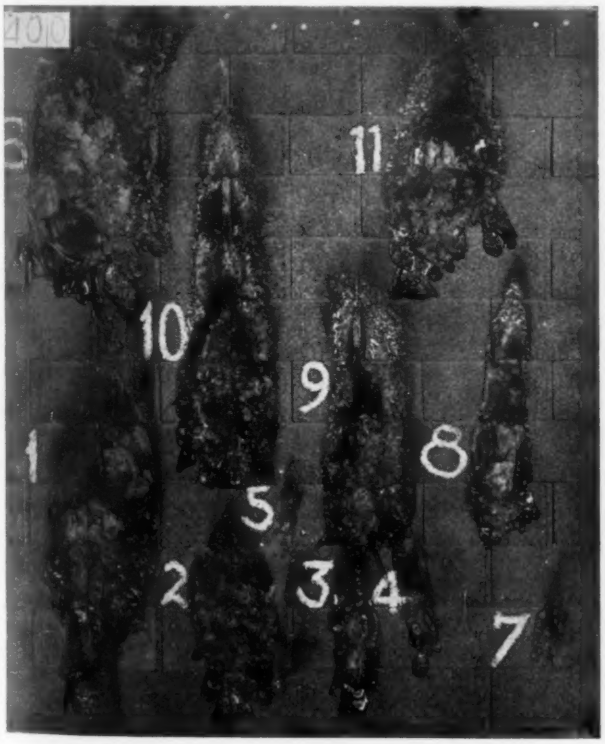
SENIOR ENGINEER, BUREAU OF STANDARDS, WASHINGTON

THE fire-resistance activities of the Bureau of Standards have been concerned mainly with research into the fire-resistive properties of materials and members entering into the construction of buildings, the fire hazard of materials constituting the contents of buildings, the severity of fires that can occur with given amounts of combustible building contents, and the protection afforded by devices such as insulated record containers.

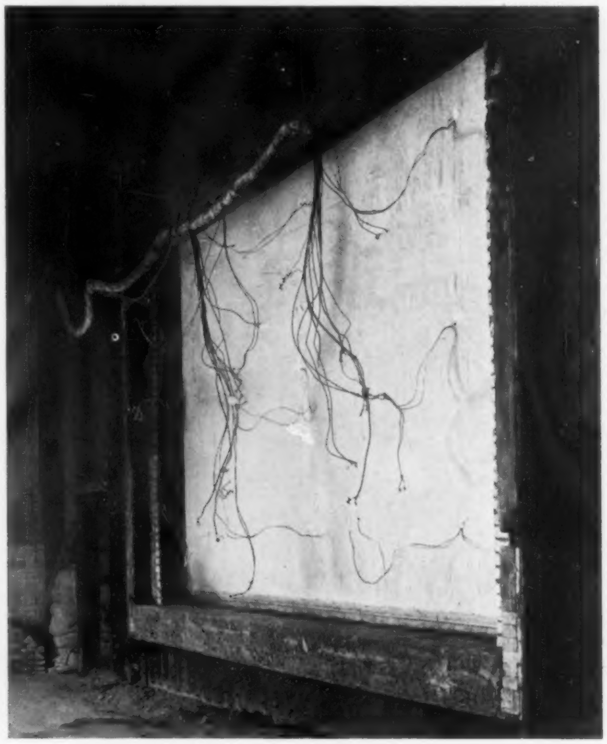
Fire-resistance, if in the form of materials incorporated into the building itself, has the advantage of being independent of the human element, upon which fire-prevention of many other kinds must depend. It loses little in effectiveness with age, remaining practically unchanged as long as the structure serves the purpose for which it was built. While general fire-prevention efforts and fire-detective and fire-prevention devices are of value, the building itself must remain as the chief factor in taking care of the margin of danger due to carelessness, ignorance and crime that cannot otherwise be further reduced. Consistent and continuing reduction in life and property loss from fire can be safely premised only on achieving greater fire-resistance of exterior and interior building members, details and finishes, a large gain in which is possible with proper application and combinations of materials now used.

The standard fire test consists in subjecting the material, construction or device to a furnace fire, the intensity of which is regulated so that given average temperatures obtain in the furnace chamber at stated times after the fire is started. By means of this control approximately the same fire exposure can be obtained at different times and in different laboratories. The other requirements will vary with the type of construction or device being tested. Thus, columns are required to support a load approximating what they would carry in a building; floor constructions and bearing walls are similarly required to support loads and also to afford resistance to flame and temperature penetration to an extent that will prevent ignition of materials in contact with the unexposed sides of the walls; incombustible finishes must serve similarly in preventing ignition of the material or construction protected; and insulated containers must preserve their contents. The fire-resistance of the material, construction or device tested is measured by the number of hours and minutes during which these requirements are met in the fire test. Ability to withstand erosion from hose streams, as applied in extinguishing fire, is also required for walls, floors and partitions.

Fire Tests of Building Columns. The initial series of tests undertaken on the basis outlined was



Deck of Prepared Roofing Shingles after Firebrand Tests with Air Currents at Ordinary Temperatures



The Unexposed Side of a Theater Proscenium Curtain Shortly after the Other Side was Exposed to Fire

Typical Failure of Unprotected Steel Column after 11 to 21 Minutes of Fire Exposure

of columns, one series, comprising over 100 tests, being conducted in coöperation with the Associated Factory Mutual and the Underwriters' Laboratories. Typical rolled steel, cast iron, concrete and timber columns were tested unprotected, partly protected and also completely encased in concrete, hollow tile, gypsum block, brick and plaster on metal lath, applied in different thicknesses. The effect of the protection in increasing the fire-resistance of the columns is evident from the fact that unprotected steel columns failed under load in the tests after from 11 to 21 minutes of fire exposure; columns partly protected by filling the interior or reëntrant portions with concrete but with the flanges exposed to fire withstood the test for periods of between 48 minutes and 1 hour, 24 minutes; and columns encased in concrete 2 inches in thickness outside of the metal developed fire-resistance of periods ranging from 1 hour, 47 minutes, to nearly 8 hours. A wide range in effectiveness was found with materials of a given class and applied in the same thickness due to differences in the amount of cracking and similar fire effects sustained. This is evidenced by the range in effectiveness found for 2-inch concrete protection already cited. Similar differences were found for burnt clay products applied as column protection. The results of these tests have been published by the Underwriters' Laboratories, Chicago, as a joint report entitled "Fire Tests of Building Columns," and also by the Bureau of Standards as "Technologic Paper No. 184." The tests deal with a building detail of the greatest importance from the standpoint of maintaining the structural integrity of the building during a fire, and the results are of interest to all concerned with the design or construction.

Fire Tests of Concrete Columns. The other series of column tests was conducted at the former Pittsburgh laboratory of the Bureau of Standards and comprised fire tests of about 60 typical reinforced concrete columns with strength tests of companion columns at room temperatures. Here also a wide range in fire resistance of columns, similar in all respects except for the sand, stone or pebbles used in making the concrete, was noted. Thus columns 18 inches in outside diameter with 1½ inches of concrete over the reinforcing steel failed under working load after from 3 to 4 hours of fire exposure when the concrete was made with siliceous (quartz, chert, granite) sand and pebbles, while with concrete made with broken limestone, trap rock, blast furnace slag or calcareous pebbles, the columns withstood the 4-hour fire test under working load and at its end under loads from 2½ to 3½ times that applied during the test. The difference in performance was determined as due to the mineral composition of the aggregates used, quartz, chert and granite inducing early spalling of the concrete when exposed to fire, while concrete made with limestone, calcareous gravel, trap rock and slag showed few effects of this kind even from very severe fires. It was further shown that a large improvement with the former type of con-

crete can be effected by placing metal mesh in the outer portion of the column to prevent large cracks and dislodgment of cracked portions. Covering or replacing the outer concrete with plaster was also found effective in increasing the fire resistance of the column. The results of these tests have been published by the Bureau of Standards in "Technologic Paper No. 272," entitled "Fire Resistance of Concrete Columns."

Brick Walls. While fire walls of brick have been long recognized as increasing the fire safety of individual buildings as well as decreasing the community hazard from spreading fires, no quantitative measurement of the protection afforded had been made until fire tests of walls, comparable in size to that of a wall panel in a building, were made by the Bureau of Standards. As subjected to the standard fire test, fire resistance periods from about 1 hour for the 4-inch partition to 9 hours or more for solid walls 12 inches thick were developed. Several types of hollow brick walls made by setting a portion or all of the bricks in the wall on edge were also tested, and while the resistances developed were not as high as for solid walls, they indicated adequacy for a considerable range of fire conditions, provided proper wall thicknesses are used. Articles giving summaries of results have been published in several outside journals, and pending publication by the Bureau of Standards, "Letter Circular No. 228," giving results for clay and shale bricks and "No. 229" for concrete and sand lime bricks have been prepared and are available on request.

Hollow Tile Walls. These hollow units of burnt clay vary in size from a unit filling the same space in the wall as two bricks to that of a 12-inch cube. The effects of the fire and the temperature transmission through the wall differ considerably from what obtains for the relatively smaller and solid brick units. The rapid increase in the use of hollow tile as a wall material prompted inquiry as to its fire-resistive properties, and the Bureau was requested to undertake tests of typical wall constructions. The first series consisted of fire exposure tests under load of piers built of tile of typical designs made from representative clays. A wide difference in fire effects was noted, ascribable mainly to differences in the mineral composition of the clay and to a less extent to the design of the unit. A further series of tests of small walls was undertaken to ascertain the effect of certain changes in raw material, manufacturing details and design. In this as in other portions of the work, coöperation with the industry was had through the Hollow Building Tile Association. The final series consisted of about 170 fire tests and fire and water tests of typical hollow tile wall constructions, 8 to 16 inches in thickness, tested (1) bare, (2) plastered or stuccoed, (3) furred and plastered, or (4) faced with brick. Depending on the shape of the unit and the clay from which it was made, fire resistance of from 1½ to 3 hours obtained for unplastered 8-inch walls,

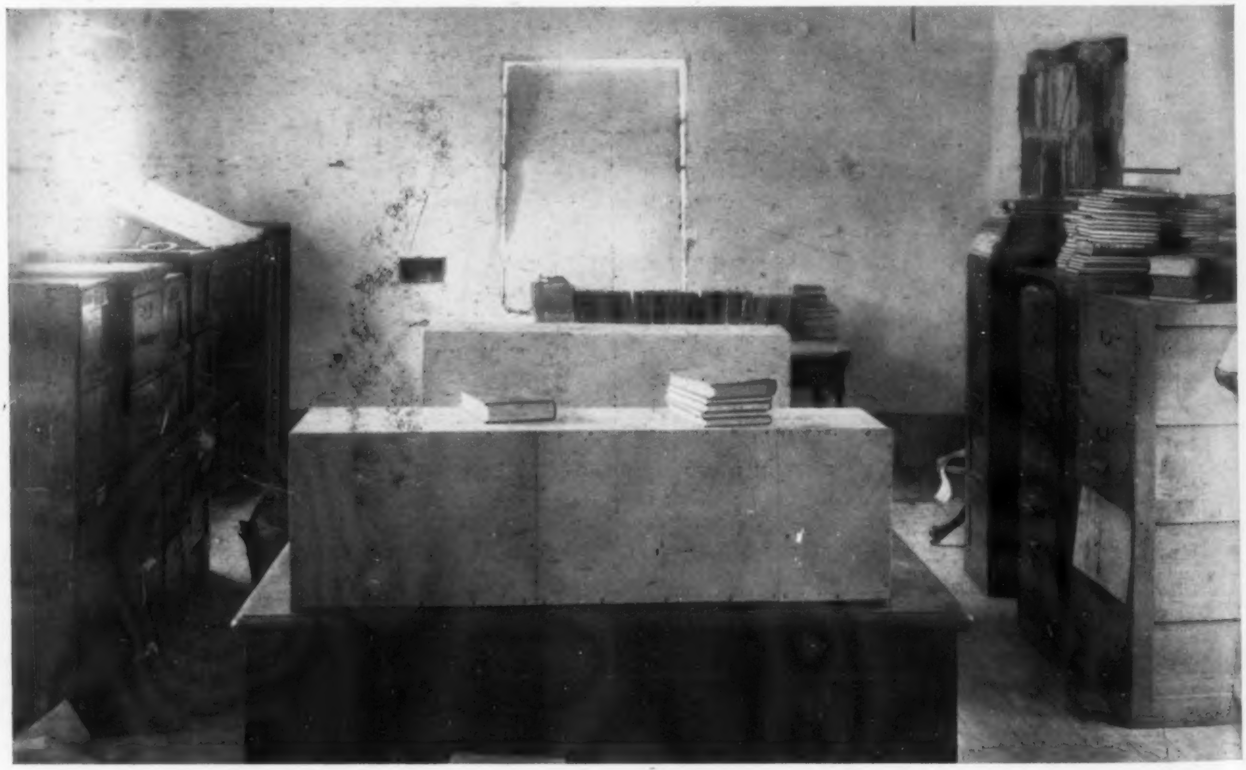
Steel Columns Protected by 2 Inches of Concrete Withstood Fire Test for Periods up to Almost 8 Hours

from 3 to 6 hours for 12-inch walls, and from 4 to 12 hours for 16-inch walls. Tile with the greatest number of cells or webs through the wall thickness was found to give the highest fire-resistance. Plaster was found to add 1 hour or more to these periods and also to decrease the fire damage. Plaster applied on split furring gave protection to the load-bearing portion of the wall to such an extent that very little damage resulted from fires of from 4 to 6 hours' duration.

The final report, giving results of all tests made, has been submitted for publication as a Bureau of Standards "Technologic Paper." It is believed that the fire-resistance of this relatively new type of wall construction has been ascertained and defined in all essential respects by these tests.

Theater Proscenium Curtains. Many disastrous fires in theaters have shown the need for a dependable movable partition or curtain for closing the opening between the stage and the auditorium in case a fire originates on the stage. The devices used vary from single-ply asbestos cloth curtains to ponderous steel-framed constructions faced with metal sheets and asbestos boards and weighing, for an ordinary opening, ten tons or more. A number of operation and fire tests were made of the different types in the Bureau's large wall furnace. The heavy constructions, properly installed, were found to be satisfactory from the operation standpoint and to keep back smoke and glow from an intense fire on the stage side for periods of ½ hour. The single asbestos cloth curtains hung between a top and a bottom pipe batten were found to be unreliable in securing closure of the opening, since drafts such as might be caused by a fire or by ventilating fans caused them to bulge and fail to come down, being held by the friction with the proscenium wall. An improved type of asbestos cloth curtain, consisting of wire-reinforced cloth applied on each side of a pipe or structural steel framework, was also tested. This can be hung so that it will be reliable in operation, and in the fire test it was found to prevent smoke and glow from showing on the auditorium side for 15 minutes. This affords time for exit from the auditorium, with a considerable margin of safety. Pending publication of the results, "Letter Circular No. 137" has been prepared and can be obtained on request. It gives a summary of results, recommended specifications for proscenium curtains, and suggestions for improving existing installations.

Fire Tests of Roofing Materials. In efforts to decrease the community fire hazard, most municipalities impose restrictions on the kind of roofing materials permitted within city limits or in certain portions thereof. The scope of such restrictive measures has occasioned much dispute, and at the request of organizations representing producers and users of roofing materials, a comprehensive series of tests of the fire-resistance of all prepared roofing materials in ordinary use was undertaken and was completed during the present year. This has included tests of new and weathered wood shingles, and asphalt prepared roll roofing and shingles, slate, asbestos, metal and tile roofings. Tests have also been made of painted and chemically treated wood shingles, both new and after exposure to the weather



Interior of Small House Simulating Office Occupancy, before Fire Test

for periods of up to 12 years. Specimens of weathered wood shingle roofs covered with asphalt prepared roll roofing and shingles or with paint coatings have also been tested. For the combustible roofings, the fire-resistance of the weathered roofings was generally considerably below that of the newly applied materials, although some forms of asphalt roofings showed little decrease in fire-resistance after weather exposures of up to 12 years. Results of the tests also emphasize the general superiority from the fire-resistance standpoint of incombustible roofing materials, such as slate, cement-asbestos, clay and concrete tile, and metal. The results of the tests are being prepared for publication in the Bureau of Standards technologic series. Copies of a preliminary report, giving the results of tests with new roofings, have been supplied to the officials of a number of cities who requested them in connection with the adoption of roofing ordinances.

Strength of Materials at High Temperatures. In connection with fire tests of building construction, it is often important to know the strength and elastic properties of the constituent materials at the pertaining temperatures. An equipment with which good temperature uniformity and control are obtainable has been in use during the past three years. Tests with structural steel and cast iron have been completed. A paper ("Compressive Strength and Deformation of Structural Steel and Cast Iron Shapes at Temperatures up to 950°C," Proceedings of American Society for Testing Materials, Vol. 26, Part II, pp. 33-51, 1926) giving results with structural shapes has been published. To this there was added a series of tests for obtaining information on effect of length, which has also been completed.

Severity of Building Fires. In order that protection requirements, such as those for structural members, wall openings and record containers, be placed on a definite basis, it is necessary to be able to make reliable estimates of the severity of fires that can arise with typical constructions and occupancies involving given amounts of combustible materials per unit of floor area. This severity would have to be interpreted as equivalent to so many hours of the standard fire test, the fire-resistance of the protections, constructions and devices to be used being measured by this standard.

Since the data obtained from actual fires are inconclusive as it concerns temperatures developed and the length of time they prevailed, some burning-out tests have been conducted in one-story, fire-resistive buildings erected for the purpose, one being 15 by 29 feet and another 30 by 60 feet in plan. These buildings were fitted with old furniture and records to represent light, commercial and record storage occupancies, the weight of the combustible contents ranging from 13 to 55 pounds per square foot. Further extension of this work to other typical occupancies is contemplated in order that the effect of any difference due to the character of the combustible materials involved may be had. The results so far obtained indicate the possibility of establishing by this means a basis for applying materials, constructions and devices as resistance against fire with as great a degree of safety and economy as they are being applied for other structural purposes.

View During a Fire Intensity Duration Test of Small House Shown Opposite

ADVERTISING ARCHITECTURAL SERVICE

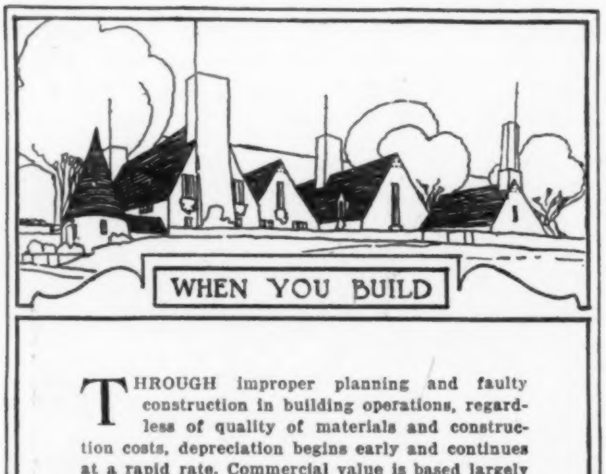
BY

M. NIRDLINGER

THE architectural members of the Architects' Council of the Chamber of Commerce of Pittsburgh recognized the necessity of acquainting the building public with the advantages derived from an architect's services. The question confronting us was how these messages could best be presented.

After many weeks of discussion, it was decided to first determine the extent to which the local architects would financially support an advertising campaign. To ascertain this it was necessary to make a general canvass among the architects. This was accomplished, and results showed a generous response which assured us of the success of the undertaking. After careful consideration of several mediums, the committee decided on newspaper advertising. We entered into a contract with a local morning paper for display advertising on Thursday of each week.

Notwithstanding the limited space possible in the first year's campaign, we succeeded in interesting the public, and received many favorable comments which proved the wisdom of our activity. We traced many direct and indirect advantages to the profession from this concerted action. Architects discontinued some of their private advertising that was without merit, and the saving was far greater than their share of our mass advertising. Due to our activity, we are receiving most friendly coöperation from the daily press. We are brought into closer contact with one another, this being most helpful in creating good fellowship. We are now recognized as business men instead of dreamers, especially by the business men of our city. This in itself removes a long recognized barrier that has stood between the practical business man and the professional man. We are showing our fellow citizen the folly of trying to secure good architecture without an architect. We are also convincing him that he cannot obtain reproduction of gems he has found in the larger cities unless he permits us the same liberty and freedom that were given the architect in the larger city. We are convincing our fellow citizen also that the service of a local architect is his best investment. It is not our intention to try to reach the men or corporations associated with important structures, since they are as a rule our clients already; but it is the small man and the small estate, corporation, etc., preparing to build.



Two of the Advertisements used by the Pittsburgh Architects
(Size as published in newspapers, approximately 4 by 6 inches)

AN OPPORTUNITY FOR ARCHITECTS

THE REVISION OF THE NEW YORK TENEMENT HOUSE LAW

BY

ARTHUR C. HOLDEN, ARCHITECT

IT has been said that opportunity does not go around wearing a label. Some even contend there is no such thing as opportunity at all, but that opportunity is a way of looking at things. The man of genius will see an opportunity in an apparently usual situation, whereas the ordinary man would pass it by. There are many men in the architectural profession who have genius, though some of them are handicapped by preconceived notions of what an architect should do and how an architect should act. A kind of self-consciousness is a handicap to genius.

There is an opportunity now which lies open to the architectural profession. The Tenement House Law of New York is up for revision. Happily, under the American constitutional system, when one state takes a step in advance, it is possible for other states to go further. Two winters ago the legislature created a Temporary Commission to Examine and Revise the Tenement House Law. Last January the Commission brought in its first report. The architects announced that since they had not had time to study the proposed law, they could not take a position either favoring or opposing it. Several months of controversy followed, and the legislature adjourned without taking action other than to enlarge the Commission and to continue it for another year. A new report will be brought in to the next legislature. Last summer was spent in further investigation by sub-committees and in conferences with civic, social and technical bodies.

The present Tenement House Law has been amended 150 times since its passage in 1901. It is due for a thoroughgoing revision. Its original passage was made necessary by the shocking revelations of the comprehensive report of the Tenement House Commission of 1900. It was the social service organizations, not the architects, who sponsored the legislation. The law was designed to restrain unscrupulous promoters from putting up buildings which were unsafe from the point of view of egress in case of fire and unhealthy because of the lack of proper light and ventilation or because of insufficient provision of sanitary equipment. The immediate purpose of the law was to protect the poorest class of people and to prevent their exploitation by overcrowding in inadequate and unsanitary quarters. The Tenement House Law is, in consequence, a law replete with "prohibitions and minimum requirements."

Since the time of the law's passage New York has doubled in population and assessed realty values have increased amazingly,—from \$3,357,224,369 in 1900 to \$14,738,806,010 in 1928,—exclusive of the Borough of Richmond. The value of the dollar has been cut in half, and methods of building have been revolutionized. We have just begun to look upon housing as an industry requiring very nice balancing of the art of design, the science of construction, and the economics of housing finance. At the time the present Commission was called into being, economic pressure was working havoc with the enforcement of the law. In all classes of dwellings methods for evading the law had become so well defined that they were reflected in property values. The old definition of a tenement house as a "building occupied by three or more families, living independently of each other and doing their own cooking," exempted from the requirements of the law any building in which theoretically not more than two families did their own cooking, no matter how many families lived in the building. On expensive land it was possible to run a towering skyscraper with practically no courts to provide light and air, if only it were called an "apartment hotel" and if the suites were provided with "pantries" instead of "kitchens." Where there existed old fashioned residences in which it was no longer economical for a single family to live, they could be converted into "studio apartments" with inadequate safeguards against fire, provided that no more than two *bona fide* kitchens were put in the same house. Where the price of land appeared cheap, it was possible to build frame houses within 3 feet of each other and to move large sections of the population into jerry-built districts unequipped with sewers.

In all of the great mass of home building in the United States during the past ten years,—taking it from top to bottom, good, bad and indifferent,—what sort of a role has the architect played? How great has been his influence upon housing construction? Has the architect been a follower or a leader? Of course there are different kinds of architects. A great deal of work is done by a class of men who might be dubbed "archytecks." They make drawings largely for the purpose of "filing" with the various building departments. Their plans show certain essential details, such as the thicknesses of foundation walls, the locations of the houses with respect to building and lot lines, and the plumbing sections. These men also perform the valuable service of getting plans "passed through the department," a labor which requires a great deal of waiting in outer offices, and which the average builder is quite willing to have someone else perform for him. The so-called "high brow" architects are very slightly interested in this class of work. They generally look down upon men whom they call "commercial architects," whose business is drawing out to ¼-inch scale the apartment plans that have been worked out by the real

Typical two-family, semi-detached houses, with courts between, which are not under the jurisdiction of the Tenement House Law. They represent good construction except for the poor lighting in the narrow side courts, which are garage driveways

Rapid depreciation, carrying costs, and economic pressure have forced the subdivision of these frame buildings into apartment suites which are not supposed to contain kitchens. These are typical of conversions made in spite of the Tenement House Law

estate men, and then designing elevations to fit. The latter work under great pressure, and their worry in life is very similar to that which plagues the high brow architect and the "archyteck,"—namely, "where the next commission is to come from."

What architects lack is point of view. I have always felt that conventions of the Institute should be held in a giant Zeppelin, and that not only the high brows but *all* architects should attend. During the reading of the report of the Board of Directors, the airship should be taken on a tour of the United States to let the architects see at first hand the conditions in architecture throughout the nation. Looking down from above, they would see tremendous building activity here and there. Below them there would also lie all the buildings erected in the country since the coming of the Mayflower,—such at least as have survived the ravages of fire, the elements, and the eternal process of rebuilding. I'm sure that the consensus of opinion of such a convention would be that the vast majority of the buildings designed to house the human family were unworthy.

I do not believe that it would be necessary to hold very many aërial conventions before the idea would become firmly planted in the minds of the delegates that there is absolutely no reason in the world why architects should not influence all of the building in the country instead of a very small part of it. There would be a ringing battlecry set up that architects must assume the leadership, that architects must "show how it could be done." From the vantage point of aërial perspective, one can see over mountains and barriers. One learns that some of those things that have appeared to set definite limits to architectural accomplishment can be circumvented. A look at the whole problem in perspective gives the architect a better conception of his task. He learns what it is that has been hampering him. For example, when the architect sees that there is preparation for the revision of any code which regulates building, he recognizes the opportunity to free himself from outworn prohibitions and to protect himself against sub-standard competition.

The over-intensive use of land is one of the evils that, unchecked, threatens to lower the standard of public health and decency. Proper sanitary protection and adequate provision for escape in case of fire are no less essential. The architect is constantly told that he must build economically; that he must not sentimentalize, and that he must keep his design close to the minimum standards of light and air, sanitation and safety allowed by law. The reason given is familiar enough to him. "One cannot afford to do better, because construction costs are so high." But construction costs, as the architect has learned, are not the only costs in producing a building. He has to reckon with the cost of land, which includes the cost of expensive improvements. He has to reckon also with the cost of financing and promotion, which, including sales costs, ranges from 25 cents to over 40 cents on the dollar of cost of the finished housing product. From the vantage point of aërial perspective, the architect would see that by accepting the cost of land and the cost of financing as factors which he is unable to control, he has been compelled with every increase of these costs to either reduce the amount of money available for construction or to crowd his building upon less land than is desirable. Confronted with this dilemma, the architect, assisted by his brother the engineer, has created the skyscraper. By reaching into the upper air above its neighbors, the skyscraper has increased the usable area of the ground on which it stands from 6 to 12 fold, and then to even 20, 30 and 40 fold. The genius of the American architect has been acclaimed around the world. The skyscraper movement, beginning with commercial types, inevitably spread to residential buildings. There is an essential difference, however, in the application. The commercial skyscraper, situated at the mart or business center, maintains its desirability and rentability to a much greater degree than does the residential

Illustration of a typical non-fireproof tenement. On such low value lands it is uneconomical and wasteful to build so intensively. Original rents can be obtained only because of borrowed light and air. The buildings are bound to depreciate when the neighborhood becomes built up

High class apartments built in exclusive residential section originally developed with frame houses on 60-foot lots. The economic unit for the new development is two lots or 120 feet, yet owners insist upon the right to build just as intensively on a 60-foot lot

skyscraper after the neighborhood around it has become built up with similar structures so as to shut off light and air. Business operations can be conducted by artificial light, but so far no one has come forward to urge that homes in which children are brought up are desirable without direct sunlight.

Today in our experience with the 6-story, barracks-like apartments, and, even with the larger 9- and 15-story fireproof buildings, we are experiencing the same tendency to depreciation after the light is shut off as was experienced with the original 6-story, dumb-bell flats erected under the law of 1879. Of course the modern building has not sunk to the low standards of sanitation and health that brought the older buildings into discredit, but the depreciation takes place none the less, and the community pays.

From the architectural observation balloon, skyscrapers,—and in particular residential skyscrapers, —are self-evidently desirable when they are placed alternately with low buildings separating them. It would of course be impossible and inequitable at law to restrict skyscrapers by law to alternate plots of ground. Therefore, the first report of the Commission offered to the legislature in January, 1928, recommended the creation of lot line courts at least 10 feet wide to begin at a point not higher above the street than the width of the street plus 5 feet. This recommendation was the greatest step in advance ever offered for the protection of high value properties against blanketing by abutting lot-line walls. Its provisions were equivalent to a proviso that no skyscraper walls could be carried up nearer to one another than 20 feet, and that in the intervening space no building could be built to a height exceeding the width of the street by more than 5 feet or to a greater depth than 60 feet from the building line. There was a great deal of complaint about this provision on the ground that it worked hardship upon owners of high value property. Such complaint was based on misconception. The Tenement House Law of 1901 limited all walls including lot-line walls to one and one-half times the width of the street. The original recommendations of the Commission permitted greater heights, but required the building to set back away from the property lines so as to protect adjacent property.

Architects are perfectly familiar with the conditions which the skyscraper creates. They know exactly what should be done to make the skyscraper more desirable and to protect it from abuse. Architects are equipped more than any other group to speak for the public good and to say what should and what should not be done. Here is their opportunity to say what good standards should be. If the architects fail in this, and if the advice which they give now is shortsighted, let no architect complain in the future that he can't do better work, that he has to meet the low standards of commercialism. Rapid obsolescence and depreciation are the direct result of low standards, and the architect has had sufficient experience with these to know that the penalty which they exact is high rates of finance, over-rapid amortization, high discounts and more cash in financing and for land, and less cash for construction proper. The architect should be the champion of the people in this. He will find them willing followers, once they realize that to follow him means ultimately securing a more stable building industry and more building for the same rent. Landlords are trained in the rule of thumb, they are not analysts; most of them do not realize what the disorganized state of the housing industry means to them. By following the architects instead of the land peddlers, they can assure themselves more stability of income, for the buildings which they get for the same money will be of higher standards, not subject to such rapid obsolescence and depreciation as at present, and therefore a better and safer investment.

The illustrations given here show some of the common types of houses that have been erected since the war. In the recodification of the law the end sought should be reasonable. In certain fields the abuses

A typical row of recently built frame dwellings. They represent an uneconomic type of construction where full assessment for street opening, paving and sewer will make necessary the ultimate replacement of such housing by a more intensive development

A 3-foot court between frame buildings. An entirely uneconomic system of planning, as the narrowness of the court destroys all usefulness except for the ventilation of bathrooms or stairs. There are types identical with this being built today

have been greater than in others; the purpose should always be stabilization of income and desirability from the tenants' point of view.

In trying to be reasonable, it is necessary to take variations in land values into consideration. Some city land is of such high value that it demands a sky-scraper type of development with all apartments reached by modern, high speed elevators. Medium-priced land, on the other hand, is susceptible to development with lower buildings of the walk-up, non-fireproof type. Cheap land should involve some approximation of rural or suburban conditions. From the point of view of theory, lower-value land does make it possible to design with wider courts and better conditions of light and air; but from the point of view of law, a really desirable standard of court sizes cannot be set, because such standards might be unreasonably restrictive to higher-value property. As a result, where good standards might easily be possible, competition operates to bring all standards down to the level of the most unscrupulous. The first report of the Commission sought to get around this difficulty by setting two standards for court sizes and for bulk of building,—one for high-value and one for low-value lots. Apparently it was a tactical mistake, for this one feature of the report brought opposition from those who claimed to speak for the owners of land. Schooled to think that a permanent "Bull" market for real estate is an economic necessity, they viewed with alarm any restriction at all upon land which would limit its potential development to something less than the limits already attained by other land.

Such a view actually retards improvement, for it begins by discounting possible improvements. The assumption that the land itself will continually increase in value amounts to saying that whatever improvements are made to the land, these improvements must grow rapidly less in value, and that the land will ultimately increase sufficiently in value to offset this rapid depreciation. This is a dangerous philosophy. It ignores the consideration that the basic value of land is derived from the stable income that comes from the land. Any law which in this scientific day and age allows the uneconomical, and unreasonable over-development of land, puts a premium on plunder. The critics of the Commission's proposal to grade the restrictions imposed upon land according to the value of the land, brought in no proposal for a more equitable method. Perhaps, since it is the fools and the "suckers" who continually pay the price of over-rapid depreciation in the form of needlessly high rents, it is outside the province of the law to protect them!

The Commission was also criticized for recommending that all classes of residential buildings should be included under the Dwellings Law. A great deal of misleading information was circulated in order to stir up opposition. Individual owners were told that their homes would be made the subject of tenement inspection in regard to sanitation and cleanliness. It raised incredible alarm. What was really intended was to make it impossible to evade the law on the mere pretense that the building was of a type which did not come within the province of the law. Only by a law which recognizes all types is it possible to encourage the better types, and to put under curb the less desirable types only in cases where abuses have arisen. Whenever a law is drafted in terms that are comprehensive, it is bound to arouse opposition. Such a law cannot be passed (nor could it be enforced, if it were passed) unless it is thoroughly understood. Above all others, the architects are they who should lead in the education of the public. If the architects stand for better types in housing, they will find their leadership irresistible, and the public will give them unqualified support.

SANITARY DESIGN IN MODERN BUILDINGS — COLD WATER SUPPLY

BY

HAROLD L. ALT

THE assurance of a continued water supply at proper pressure is the most important consideration in designing sanitary equipment. While there are many comparatively small installations depending entirely on direct city pressure, the larger buildings almost invariably utilize house tanks. This is because the water reserved in the house tank is usually sufficient to carry over any temporary cut-off of the street supply, and because the use of the tank also insures a constant water pressure on the plumbing fixtures without fluctuation, such as often occurs in the city mains. It will therefore be assumed in this article that a house tank is contemplated. When the tank is made a combined house and fire tank, the capacity is often about 5,000 gallons, which allows a fire reserve of 3,000 gallons and another 2,000 gallons on top of this for building service. These two quantities are prevented from interfering with each other by taking the fire connection off of the bottom of the tank (or from the side near the bottom), and the building supply off the side of the tank three-fifths of the distance up from the bottom of the tank to the water line, as shown in Fig. 1. A 5,000 gallon tank must contain about 700 cubic feet of water, and the sides must carry up about 12 inches above the water line. Thus the dimensions of a 5,000 gallon tank could be 10 feet long by 10 feet wide by 8 feet high. The building supply opening would be on the side three-fifths of 7 feet or 4 feet, 2 inches above the bottom. With the tank full, there is available for fire use the entire contents, but with the tank drained down to the level of the building outlet,—below which it cannot go unless leaving through the fire outlet at the bottom,—there are still 3,000 gallons left for fire service. The piping in such an installation is frequently arranged as shown in Fig. 2. Of course if the fire tank is kept separate from the house tank, the building service would be taken from the bottom of the tank. In some cases the demands of the authorities for water storage are much greater. For instance, in a theater they may insist on 5,000 gallons reserve for sprinklers, 5,000 gallons more for fire standpipes, with whatever amount is desired for house service added to this (usually 2,000 to 3,000 gallons more.) This makes the combined tank capacity between 12,000 and 13,000 gallons.

House tanks must rest on substantial supporting walls or columns, since the weight of such tanks when filled is about 5 tons for each 1,000 gallons. House tanks are usually constructed of steel and are square or rectangular in shape. A middle partition is desirable with duplicate valved pipe connections to each side so that one-half of the tank may be cleaned, painted or repaired without disturbing the water in the other half. A curb angle about 3 x 3 x 3/8 inch is run around the top to stiffen the edges, and vertical angles about 2 x 2 x 1/4 inch or 2½ x 2½ x 1/4 inch are used to prevent the sides from bulging. The middle partition ties the two sides together and must be stiffened against pressure in either direction. Under the tank 12-inch to 18-inch I-beams are placed on edge to permit access for painting and repairs. These beams often rest in a drip pan of steel about 1/8 inch thick, the pan projecting 6 inches outside of the tank all around and turned about 3 inches around the edge. A 2-inch drain is run from the drip pan and connected to the tank overflow pipe so that any condensation occurring on the sides of the tank will run down into the drip pan. The pan is supported in turn on a second set of I-beams which are arranged to come directly under the upper tier of beams. A typical steel house tank is illustrated in Fig. 3.

In order to fill the house tank three different sets of conditions must be considered: (a) whether the normal street pressure is sufficient to fill the tank at all times without the use of a pump; (b) whether the city pressure is sufficient to fill the house tank only part of the time, and at other times is inadequate to raise the water into the tank; (c) whether the city pressure seldom, if ever, is sufficient to raise water into the house tank. In the first case, all that is required is a float valve on the tank to shut off the water whenever the tank is full and to open up the supply line whenever the water level in the tank begins to drop. In the second instance, a pump must be used to keep the tank filled during times of low street pressure. This pump should be of centrifugal type so as to allow the water to flow through it up to the tank whenever the street pressure is sufficient; there must be a float control in the tank which will start and stop the motor on the pump whenever the water line fluctuates, and there must be a ball cock on the discharge into the tank so that the street pressure will not overflow the tank continuously whenever it is high enough to force water into the tank. In the third case, any type of pump with float control from the tank will fulfill the needs.

For buildings over 150 feet in height it is advisable to use a system of water supply with two pressures, so that the water pressure in the lower part will not greatly exceed 50 pounds per square inch. A house tank may be installed somewhat above the middle story to supply the lower portion, and a second tank on the roof to supply the upper stories. These tanks may be filled: (a) by using two house pumps, one for each tank; (b) by using one house pump and pumping all the water to the upper tank with a pipe from the upper tank to the lower con-

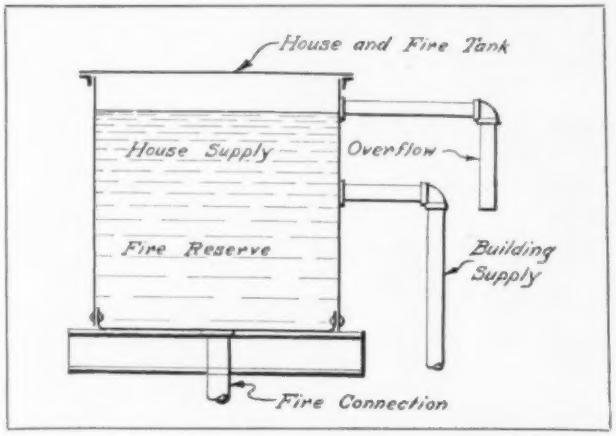


Fig. 1. House Tank, Showing Supply, Overflow and Fire Connections

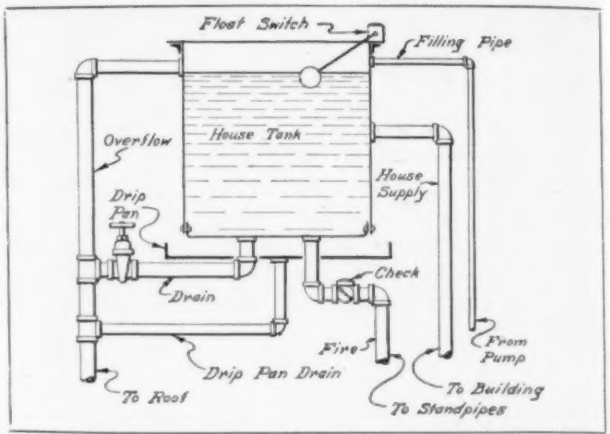


Fig. 2. House Tank, Showing Connections Frequently Employed

trolled by a float valve in the lower tank; (c) by using one house pump to deliver all the water into the lower tank and a booster pump to raise the water for the upper tank from the lower tank level. These three methods will be clearly understood by referring to Figs. 4, 5 and 6. The first method has the objection of requiring four pumps,—two to do the work and two to serve as emergency pumps in case of breakdowns. Owing to the difference in heads on the pumps, it is hardly practical to attempt to use only one pump as a standby. This method does have the advantage of economy in operation, as the water pumped to each level is only the water actually required at that level. In the second method only two pumps are required,—one being a standby,—but all the water required on the lower level must be pumped to the higher level first, and this means a much greater power consumption than in the first scheme. As a substitute for this, the lower tank may be omitted and a pressure-reducing valve placed in the line so as to cut the pressure down to the same pressure as would be obtained with the use of the lower tank. This is illustrated in Fig. 7. The

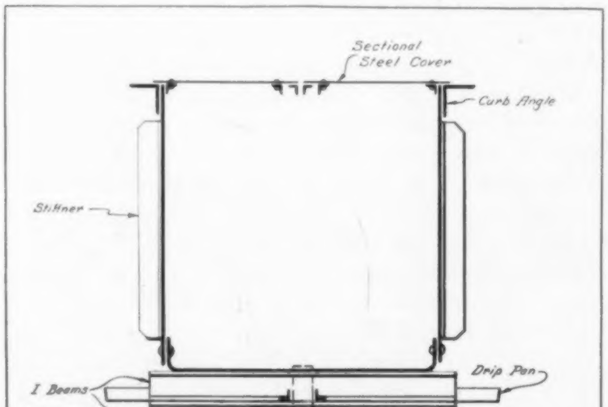


Fig. 3. Typical House Tank Construction

third method also involves use of four pumps, and has the disadvantage of having the pumps far apart. It is seldom used, possibly on account of this drawback.

The Downfeed Cold Water System. With a house tank in the building, this is the most economical method of water distribution. An overhead main is run on or above the ceiling of the top floor, usually in the furred space under the roof, and all cold water lines branch off this main and drop down the side walls or in any other position where they may be required. Branches from this main may be made from a tee turned in any direction, but the most desirable method is shown in Fig. 8. When the construction of the building is such that it does not permit the running of an overhead main, an upfeed system must be employed with the large supply pipe in the basement, and this is the usual method employed in buildings on direct pressure when the water connection from the street enters the basement. Where two pressure systems are in use, an overhead, downfeed system may be used for the upper portion and an upfeed system for the lower portion. This will eliminate horizontal piping and mains in the middle story of the building.

Pipe Sizing. The determining of the necessary cold water pipe sizes for a large installation is a matter of judgment, experience and calculation. Unless some mathematical basis is used, one error may lead to another and seriously affect the whole work. One way to check the diameter of the cold water supply pipe, either main or branch, at any particular point, is to determine the number of fixtures to be supplied and then to take each fixture or group of fixtures and determine what the average load on the line would be. In order to do this, certain factors must be assumed for each fixture according to the size. Thus, fixtures may be divided roughly in this way:

	Factor
(a) Those with ½" connections (lavatories and sinks)...	1
(b) Those with ¾" connection (sinks, slop sinks, baths).	4
(c) Those with ¾" to 1" connection (urinal flush valves).	9
(d) Those with 1" or 1¼" connection (w. c. connections)	24

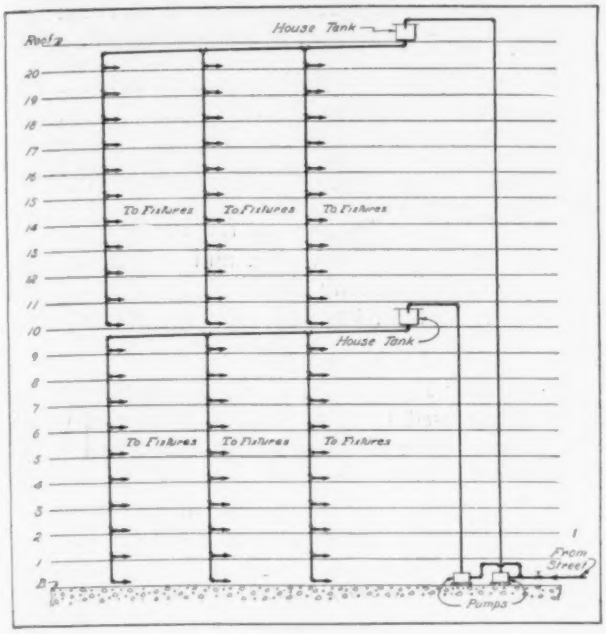


Fig. 4

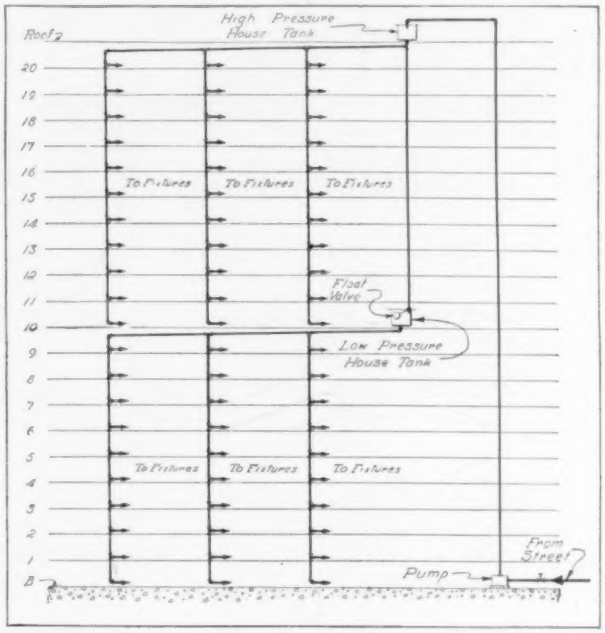


Fig. 5

The sum of all the factors on the line may then be used to determine the pipe size if this sum is first multiplied by a percentage of use based on the percentage of fixtures likely to be turned on at one and the same time.

The various sizes of pipe are also rated in corresponding factors, these being:

Size of Pipe Inches	Factor Allowed
½	6
¾	11
1	17
1¼	30
1½	40
2	66
2½	96
3	148
3½	198
4	254
5	400
6	580
8	1000
10	1600

To apply this system it is still necessary to size the first few fixtures on the branch by judgment, and then to use the factors for determining the sizes of main branches, risers, or supplies. For example, assume five toilet rooms on a riser, each toilet having

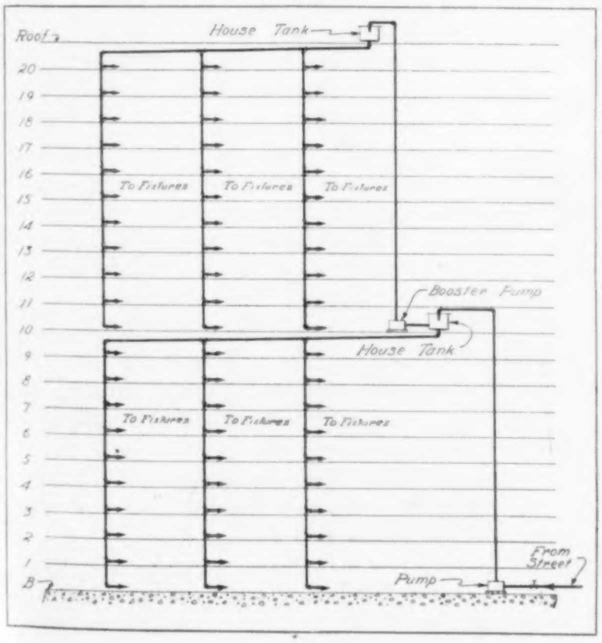


Fig. 6

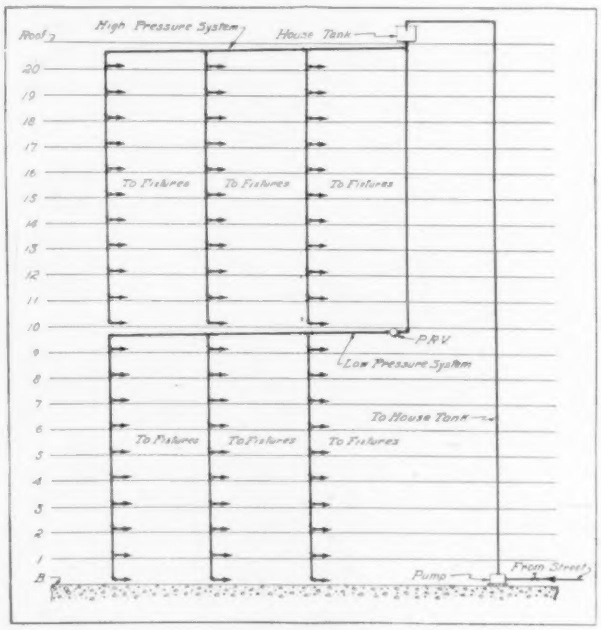


Fig. 7

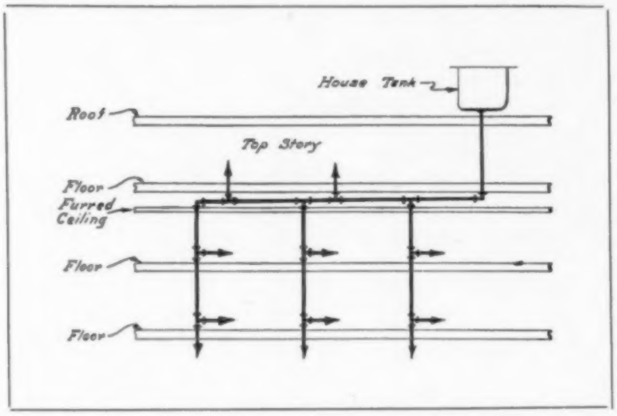


Fig. 8. Method of Connecting Branches of Downfeed System

five flush valve water closets, three flush tank urinals, five lavatories, and one slop sink; what would be the size of the branch to the toilet and what would be the size of the riser?

Fixture	Number	Factor	Equiv. Factor	Percentages of Use	Net Factor
F. v. water closets..	5	24	120	40	48
F. t. urinals	3	1	3	33	1
Lavatories	5	5	25	60	15
Slop sink	1	4	4	0	0
Total			152		64

The size of pipe having a higher factor rating than the net factor as computed is 2-inch pipe. It will be noted that the "percentages of use" are based on two water closets out of five being flushed together (or 2/5, which is 40 per cent); one urinal out of three (or 1/3, which is 33 1/3 per cent); three lavatories out of 5 (or 3/5, which is 60 per cent); and that the slop sink is neglected because it is not generally in use when other fixtures are.

Since the branch to the toilet must be 2-inch pipe, the riser size to the top toilet (assuming an upfeed system) must also be 2-inch pipe. But after taking in the second toilet, the riser will begin to have a more equalized load, due to the larger number of fixtures. With a single fixture the size of pipe would have to be based on a "percentage of use" of 100, owing to the fact that when the fixture is turned on it is running at the rate of 100 per cent. But with 1000 fixtures the average use runs only about 33 1/3 per cent because all the fixtures are never turned on at the same instant. As a result of this, the "percentage of use" will constantly recede from 100 and will continuously approach 33 1/3, and, sometimes, be as low as 25 as the number of fixtures is increased. After two toilets are connected to the riser, a total of 26 fixtures is being considered, and this average "percentage of use" should approach the general average of 33⅓ by reducing the "percentage of use" to, say, 40. Then the total sum of equivalent factors (taken at 100 per cent) must be multiplied by 40 to find out the net factor for each toilet and thus multiplied by 2 for two toilets, thus:—

Total equivalent factors,—top toilet.......152
Multiplying by a percentage of 40 per cent equals:

Net factor for each toilet................ 60
Net factor for two toilets.................120
Size of pipe for this factor........... 3 inches

With three toilets the percentage of use could be reduced to, say, 38% giving

$$152 \times 3 \times 38\% = 173 \text{ factor}$$

which requires 3½-inch pipe, and with four toilets and 35% use the result is

$$152 \times 5 \times 33\ 1/3\% \text{ or } 253 \text{ net factor}$$

which also requires 4-inch pipe.

Pneumatic Tank Systems. While pneumatic tanks are seldom used for large buildings, they are sometimes installed in smaller structures and have several advantages. They may be buried with only the heads projecting through the foundation walls, or they may be set in the basements and do not introduce heavy loads at the tops of the buildings. They will give better pressures on the top floor than when a house tank is used unless the house tank is set at a considerable distance above the highest story. They have some serious disadvantages. One of these is a fluctuating pressure on the water line; that is to say when the tank is "pumped up" the pressure is high, and when the tank is "down" or close to the point where refilling must commence, the pressure is low. The less the pressure variation is made, the smaller will be the amount of available water or "storage capacity." The pressure in the tank is due to the air compressed above the water. This air generally occupies about one third of the total tank, as illustrated in Fig. 9, so that this portion of a pneumatic tank can never be used for storage of water and is lost as far as water supply is concerned. But the remaining two thirds, which is filled with water, is seldom all available because before all the water is withdrawn from the pneumatic tank the air has expanded to a point where the air pressure has fallen too low. To overcome this some pneumatic tank manufacturers put an initial air pressure of about 20 pounds, as shown in Fig. 9, on the tank before the water is pumped in. The water is pumped in against this initial air pressure, and the entire amount of water may be withdrawn from the tank before the water pressure (due to the air) falls to 20 pounds. The difficulty encountered in this procedure is that with an initial air pressure of 20 pounds, the quantity of water which may be pumped into the tank without producing excessive pressures is also reduced. In ordinary practice it is customary to decide how much pressure fluctuation it will be safe to permit on the system, and to base the pneumatic tank design on this amount. If it is assumed that 1000 gallons available water storage is desired and that a maximum pressure fluctuation of 20 pounds is permissible, the problem gets down to determining what size of tank will have the air pressure drop 20 pounds when 1000 gallons are withdrawn from it. The size of the tank and

the initial pressure can be easily calculated by the engineer of the tank manufacturer, assuming that the 20 pounds variation will occur between 60 pounds maximum and 40 pounds minimum.

Air Cushions. Every good water supply system has provision made to overcome water hammer and noise in the piping. This danger is minimized and in many cases entirely overcome by (a) employing ample pipe sizes to prevent excessive velocities in the pipes; (b) limiting the maximum pressure under which the water system operates; (c) the judicious and adequate providing of air cushions to absorb the shock of the moving water column when the flow is suddenly stopped. The impact caused by the sudden stoppage of a moving column of water is increased by increasing the velocity, by lengthening the run, by increasing the pressure, or by reducing the pipe size. An air cushion placed at the top of the riser (in a downfeed system) allows the column of water in the riser to shoot up (or down) into the air cushion, which acts to take the impact and bring the pressure to normal. Similar cushions at the end of each branch pipe, formed by turning up the end of the branch a distance of from 12 inches to 18 inches, produce similar results in the branches, and small diameter cushions just back of each fixture are frequently used in first class work. Fig. 10 illustrates a typical pipe installation with the air cushions properly placed.

There are those who argue that air cushions are an unjustified expense because they become waterlogged in time and in that condition are no better than if the pipe were "dead ended" in the first place. It is quite true that the water will gradually absorb the air from a cold water air-cushion, making it useless. The air can be replaced by draining the line and then turning the water on again. Water logging does not occur on the hot water line air cushions, as the hot water constantly gives off air and automatically keeps the air cushion properly filled. There has not been offered a better or more practical solution to the water hammer problem than the use of air cushions. Air cushions are usually installed on the branch from the street to protect the meter from damage when the street pressure may be shut off and then turned on again. Another place where a cushion is particularly desirable is on the discharge side of a pressure-reducing valve to prevent noise from opening and closing of the valve.

Valving of Lines. There are three matters to be kept in view when deciding on locations of valves: (a) to locate valves so that various sections of piping may be closed off for repairs or other purposes; (b) to put in as few valves as possible, and to use one valve for as many purposes as possible; (c) to locate all valves in accessible places, so that they may be manipulated without too much difficulty. It is the general practice to place a stop valve on each fixture, particularly when the fixtures are in large groups in first class work. Stop valves are located

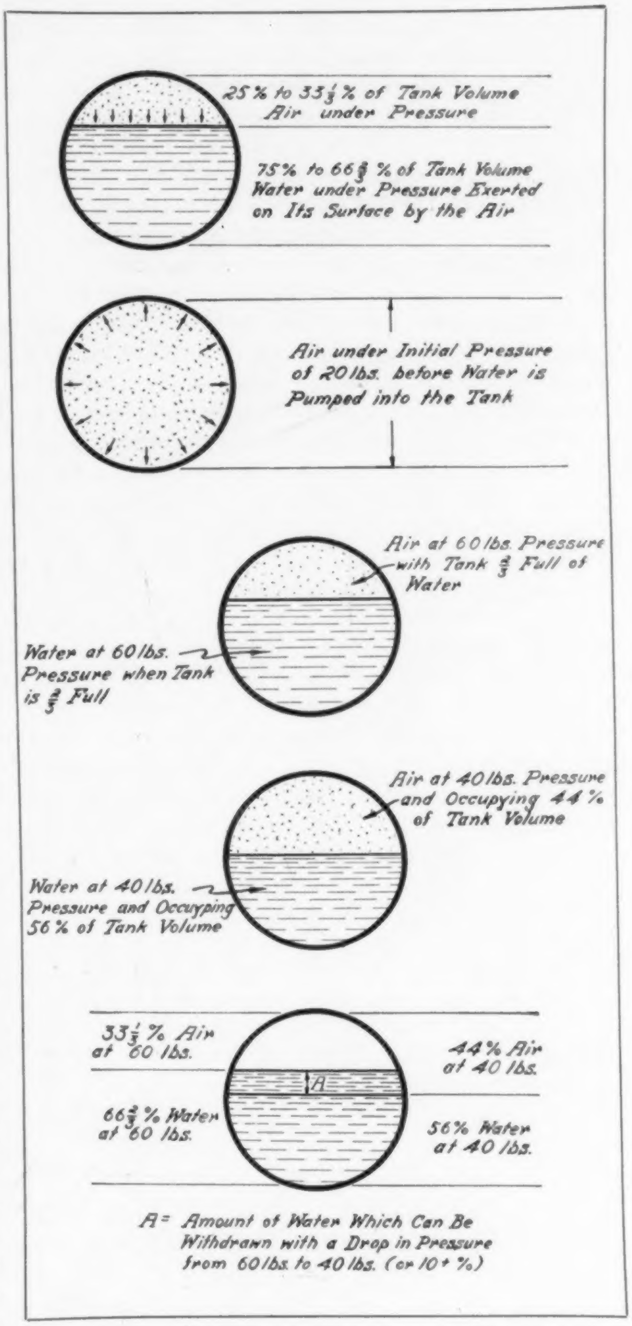


Fig. 9. Pressure and Water Conditions in a Pneumatic Tank

under lavatories, in the vertical supplies to bath tubs, and in the flush valves for water closets and urinals. Slop sinks are usually arranged with valves on the supplies somewhere in the slop closet, or the valves may be omitted on this fixture altogether. Sinks may be valved under the fixture or,—as these fixtures are usually set singly,—on the branch to the fixture. A valve is generally employed on the branch from the riser and is located close to the riser. This valve controls the branch to the toilet room and, consequently, all fixtures on that branch. In cases when the fixture branch only has a few fixtures, such as in the bathrooms of apartment houses or

hotels, it is permissible to omit the fixture valves to save on installation costs. Lavatory stop valves have an advantage in making it possible to regulate the flow from the lavatory faucets to prevent splashing.

The riser itself is usually valved where it leaves the main. This permits cutting off any particular riser in which trouble may develop without affecting any other riser. Frequently the main itself is valved at the various principal branches, but this is often omitted and may be considered as desirable but not absolutely necessary. Of course each piece of apparatus must be valved, and pumps should be valved on both suction and discharge sides, as well as having a check valve placed on the discharge between the stop valve and the pump. Water meters are valved on both sides and are sometimes provided with by-passes. The house tank is valved; the cold water to the hot water heater and the water supply to the boiler are both valved and provided with checks. Wherever a check valve is used, it is highly desirable to have a valve on each side so as to permit opening and examining the check at any time. All valves used on water lines should be of the gate type, owing to the almost negligible amount of resistance which they interpose in the line in comparison to globe valves. Customary practice employs all brass gate valves of from ½- to 2-inch size, and iron body valves, bronze mounted on sizes 2½ inches and over; they are usually of the screw type up to 4 or 6 inches, but are flanged in larger sizes.

Material of Cold Water Pipes. Cold water piping in the best work, and where character of the local water supplied permits, may be made of brass pipe, iron pipe size, or of red brass or red metal. Brass pipe usually contains about 65 per cent copper, while red brass or red metal runs to 85 and sometimes to 88 per cent of copper. There are some localities where the use of brass and red brass pipe is not practical, owing to the characteristics of the local water, and this matter should be carefully investigated. If cost is a consideration, galvanized genuine wrought iron pipe is used with excellent results. Added first cost reduction may be effected by substituting the spellerized pipe on sizes 4 inches and smaller. Above 4-inch pipe, either genuine wrought iron or steel may be used, the steel being somewhat less in price. The all-steel piping is the cheapest, where water analysis permits, and it will answer the purpose for many years. Fittings for cold water pipe are nearly always made of galvanized cast malleable iron, beaded pattern, screwed, up to 6 or 8 inches, and then flanged in larger sizes.

Underground Lines. Where water pipe is run underground and the size is 4-inch or over, regular cast iron water pipe is used, and it is not unusual to raise underground lines of lesser sizes to sizes where cast iron water pipe with calked lead and oakum joints can be employed.

Draw-offs and Drains. It is good practice to provide drains at all low points in the piping system and on risers just beyond the riser stop valve. These drains are nearly always ¾-inch size, with valves having hose threads so that a hose can be coupled on and run to floor drains or pails. To aid in this draining out, it is desirable to pitch all cold water lines back toward the riser, and the riser branches back toward the main, and the main back toward the meter, so that any line may be properly drained.

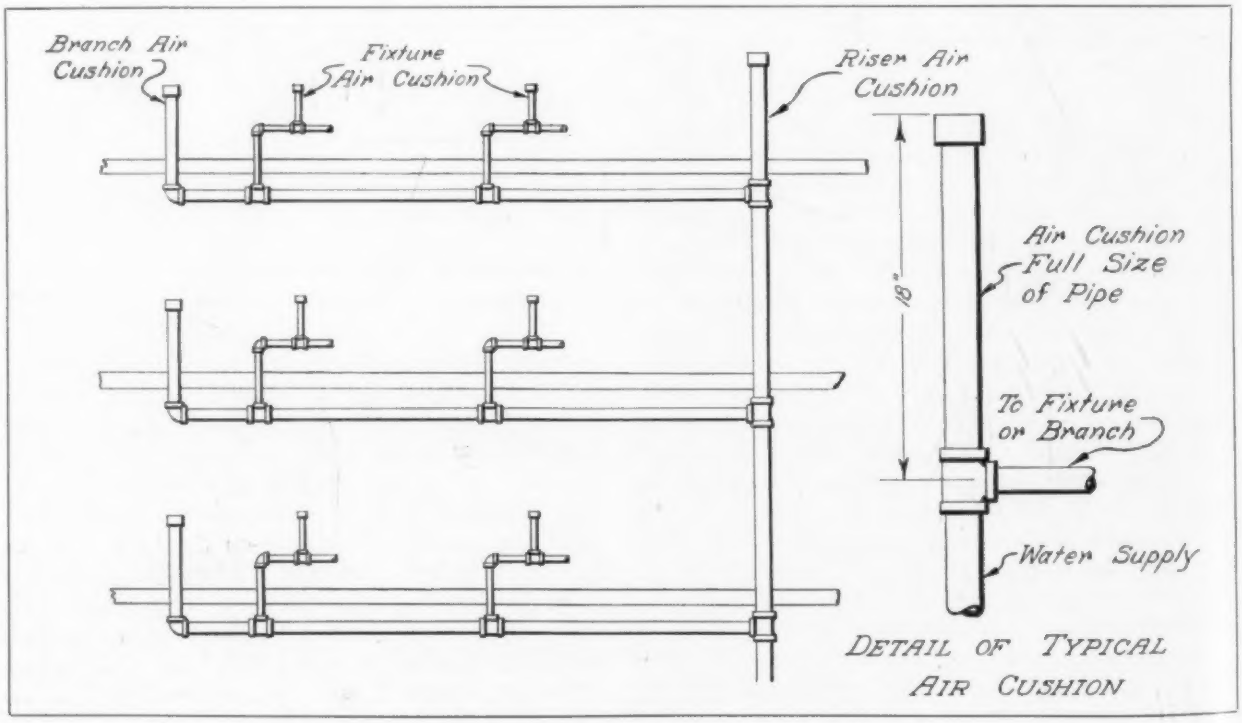


Fig. 10. Typical Air Cushion and Proper Placing of Air Cushions

THE ARCHITECT AS CONSTRUCTOR

PART III—OPERATING A CONSTRUCTION ORGANIZATION

BY
WILFRED W. BEACH

IN preceding articles on this subject, in THE ARCHITECTURAL FORUM for May and August the author discussed the possibility and feasibility of members of the architectural profession attempting to circumvent an apparently increasing tendency of general contractors and constructing engineers to include in their proffered services the functions of the architect. Obviously, the services of an architect are essential to the success of a building, if it be of any consequence. Whether or not the services of the general contractor are likewise, may be considered open to question. If either is to survive to the exclusion of the other, it would seem probable that the individual who creates is most likely to be he who will carry on. But we are facing no such extremity.

The pertinent thing we are presumably facing is the loss of particular commissions to contractors who "furnish plans." If there be owners who prefer this sort of service,—who are convinced that the method is fundamentally sound,—why should it not be the duty of the architect to accommodate them, especially if the architect can convince himself that both client and the architect as builder are to profit considerably thereby? We have therefore shown how it is possible for the architect to acquire new business of this character, and have set forth a contract form to cover an agreement with such a client (THE ARCHITECTURAL FORUM, August, 1928, Part II). The signing of the first of such contracts by the architect should be indicative of his fixed intent to add field construction to the functions of his office. The departure is too comprehensive to be invoked for a single operation, there to deliberately stop. To be sure, he is burning no bridges by the innovation. So long as he guarantees no costs, he is in no way jeopardizing his status as an ethical architect, nor is he necessarily setting himself at loggerheads with the better class of contractors. They may not approve of his entering their fenced preserves, but they will still (most of them) continue to bid on his work when invited, knowing that he will not ask them to waste time figuring on work which is not intended to be let. In other words, one can be both architect and cost-plus builder without encountering insurmountable obstacles.

Having secured the contract, one proceeds to organize the project while working drawings are being completed. One must determine what work is to be sublet and what is to be executed with one's own forces, and must prepare specifications accordingly. It will be found that the duties of the office man in charge of contracts and construction have increased many fold, and that he must be prepared to meet them, whether he be the architect himself or an employe. It may be found advisable to bring in a construction manager from outside if no one in the organization has special fitness for the tasks confronting the office. On the other hand, an architect with inclinations in that direction can readily augment his knowledge of the subject by reference to any one of several up-to-date books on construction methods and management. As work increases, one will add departments of purchasing, expediting, accounting etc., always holding down the overhead to its efficient minimum.

The trades most generally handled through foremen are concrete work, masonry, carpentry, lathing, plastering and painting. General excavating had best be sublet, as a rule, because of the special equipment needed and because men in that line generally know what to do with excavated material. Such a contract should not include the necessary hand-digging of pits and trenches, which can better be handled by common labor under the general foreman or a "straw boss." Piling and deep foundation work, with its necessary shoring, should also be sublet to experienced concerns equipped to do such special work. But by the time the constructing architect is ready to execute large work and heavy construction, he will have gained the necessary preliminary experience and will have found that each commission presents its own problems, beginning with the excavating and continuing through the last detail of the decorating and equipping.

Bids are taken and contracts awarded on the items first needed, as rapidly as drawings and specifications can be issued to bidders. In addition to asking bids of local concerns, if the work be outside a large city, one makes careful canvass of all others available, getting, if possible, three or more bids on each subcontract and material list. The preparation of the latter is, of course, new procedure for the architect. A builder does not hand a set of prints and specifications to a material supply house as he does to a plumber or other subcontractor. Instead, he prepares itemized schedules of lumber, brick and the like, and gets prices accordingly. Contrary to general opinion, there are no standard fixed prices of building materials. There are "list prices" and "quoted prices" and "customary prices,"—and there are also the "prices that are necessary to get the business." Hence the perspicacious purchasing agent. He is quite likely to find that some of the owner's "friends" in the building supply business have had their eyes on this particular project for some time,

and have perhaps been avidly anticipating their profits. In this, as in all other lines of commerce, there are two distinct classes, each intent upon doing the "right thing." But to one, it means the right thing for the *customer*, and to the other the right thing for the *dealer*. To the latter, a legitimate profit means whatever he can get. The purchasing agent must be able to discriminate, as it is up to him to adequately protect the owner against those of his neighbors who are out to gouge him. Furthermore, they would like to be able to show their regular customers that they exacted toll from the outsider. The owner will give his builder a list of those from whom he wants prices,—he may even secure some of the prices himself,—but he should be explicit as to which if any he wishes to have specially favored. Frequently, the association or connection between owner and purveyor is so close that the former especially welcomes the intervention of a purchasing entity to shoulder all responsibility. The construction architect has no axes to grind but can distribute his favors exactly as he and the owner decide is best for the project. They may decide that the ownership of stock or a position on the board of a company does not warrant buying from the incumbent at fat prices, as a local builder might have to do.

As has been intimated, no one individual is more vital to the success of the undertaking than the general foreman. It is to be assumed that he will be chosen with the utmost discrimination. If new to the organization, he will be brought into the office and made thoroughly familiar with its general practice and with the intended procedure in his particular work. He will take time to familiarize himself with the drawings and specifications, material lists and subcontracts. If he is being merely moved from job to job, he can do this in the field. Nevertheless, it is well to give him time between assignments to come into the home office and be checked up,—to get acquainted with his co-workers. It makes *esprit de corps*.

In any event, it is essential that the home office shall have prepared a detailed set of instructions to superintendents or general foremen (as they may be called). Oral advice lacks uniformity, adequacy and force,—leaves too much to the judgment of the individual. He has abundant opportunity to exercise his initiative, even after complying with all home office "red tape." After digesting his instructions, his experience will tell him what is mandatory as well as where he is supposed to "use his head." But, for regular procedure, he should be placed in a position to know what is expected of him without having to ask. If he is the right type of man, he will appreciate printed instructions, even though his previous employers have had nothing of the kind, and any advice may irk him somewhat. Some of the best foremen will put all their energy into pushing the work ahead rapidly and capably but, when it comes to keeping their records and correspondence in shape, they will be beautifully "balled up." They are simply not office men. Foremen of that type should, if big enough, be used on larger work where one or more clerks can be assigned to assist in the time keeping, petty purchasing, receiving, storekeeping, expediting, cost accounting (distributing), and correspondence. It is up to the construction manager to determine how much of such "overhead" the work requires. It is easier to provide too much than not enough. There should be no one in the job office whose time is not fully employed,—crowded. Nothing so demoralizes a field organization as lack of employment. If clerks haven't enough to do to keep them busy, their spare time should be given to such manual labor as can be assigned them. If their white collars are inclined to wilt too much in arduous toil, they may as well get out of the building game before they have wasted too much time at it. This applies to foremen as well. The working foreman who forgets to watch his men while he is working with them may be a poorer investment than he who does nothing but oversee them. The most valuable type is the man who can do both efficiently. Foremen's time goes on whether the work does or not. When interruptions occur and men must be laid off, the good foreman allows nothing to slacken, but pitches in at whatever he can do to lessen the expense of the lull, whether it be for a day or a fortnight.

The drawing up of a set of instructions for the guidance of general foremen should deal with fixed office practice as applicable to the average project. Special conditions demand specific rulings, and no attempt need be made to provide for such exceptions in a formal guide. The instructions included here have been in practical use for some time, being revised as was proved necessary by experience.

1. *The General Foreman's Responsibilities.* The general foreman will act as the representative of the building company on the job and will have entire charge of it under instructions from the home office. He will lay out all the work and superintend all construction and be solely responsible. He will *personally* sign all payrolls, reports, and correspondence.

2. *Drawings and Specifications.* The general foreman will be supplied with as many copies of prints and specifications as may be necessary for his own use and for the use of subcontractors and foremen; he must keep careful record of them, and see that they are not mishandled or mislaid.

3. *Issues and Revisions.* Preliminary prints are sometimes issued for the purpose of starting excavating or foundations before working drawings are completed. When these or later prints are superseded by revised issues, the general foreman shall make careful note of all changes and their effect, if any, on the work already done or laid out, and shall have a distinct understanding with the home office regarding it. He shall also observe due caution that superseded prints are marked "Void" and not left accessible, where they might be subject to misuse.

4. *Checking.* As soon as prints and specifications are received, the general foreman shall carefully review and compare them and check all features in a

general way. He shall then notify the home office that this has been done, calling attention to errors or discrepancies, if any have been noted. This is important and must not be delayed; it may affect later work.

5. *Job Program.* As soon as the construction manager has assigned a general foreman to a project, they will confer and outline a job program, by means of which will be determined the sequence for ordering all materials, dates when they should be ready, and the degree of advancement of the whole work at each fortnightly interval. It shall thereafter be the duty of the general foreman to live up to this program or to show reason for each specific lapse.

6. *General Purchasing.* General purchasing is done through the home office, each order in triplicate;—one to the vendor, one to the general foreman, and one to the home office file. If the owner so requests, a copy is sent him also.

7. *Material Lists.* The general foreman (or such other person as designated by the home office,) will prepare accurate lists of all materials for the work, except such as are included in subcontracts. If not prepared by the general foreman, they must be checked by him and either approved or criticised before being requisitioned. Lists must cover exact materials specified, or else adequate reason be given for variation. They must also state the use of each article listed, the time it is needed at site, how it is to be delivered, and whether quantities given are net or whether allowance is made for waste and shrinkage.

8. *Requisitions and Expediting.* As soon as possible after a project is assigned, program arranged, material listed and checked, the general foreman shall begin requisitioning the home office for material and shall continue doing so in proper time and due sequence until all has been taken care of. Each requisition shall be accompanied by approved material lists, if needed, the number of the purchase order, if one has been issued, and such information as the general foreman has to offer as to the best available source of supply, proper price, etc. He is expected to make all requisitions well ahead of time needed (which shall be stated on requisitions), and to follow up requisitions, not permitting the home office to lose sight of his necessities. Slackness in this particular is much worse than over-insistence. Whereas the general foreman is giving his whole attention to his particular work, he should bear in mind that it is only one of several in the home office, and hence his is the greater responsibility. If he foresees delay in receipt of anything, he should use his best efforts to expedite it or, if beyond his ability to do so, he should ask the home office for special assistance.

9. *Job Purchase Orders.* The general foreman (or the purchasing agent assigned) will make such purchases from local dealers as have been previously arranged for by the construction manager. For all such purchases (except items of less cost than $1, bought out of petty cash) a job purchase order must

PURCHASE ORDER

THE W. W. BEACH COMPANY
ENGINEERS ARCHITECTS BUILDERS
SIOUX CITY, IOWA

OWNERS COPY

P. O. NO. ____________
(This number must appear on your invoice)

ADDRESS ____________

NAME OF JOB ____________

DELIVER TO THE W. W. BEACH CO. AT ____________

CHARGE TO WORK ORDER NO. ____________

CARE OF ____________

ORDERED ____________

VIA ____________ R. R. OR EX.

REQUIRED ____________

EACH ORDER MUST HAVE A SEPARATE INVOICE, RENDERED IN TRIPLICATE, SENT TO US AT

INVOICES NOT IN OUR OFFICE BY THE THIRD DAY OF THE MONTH FOLLOWING DATE OF DELIVERY, WILL BE TREATED IN ALL RESPECTS AS THE FOLLOWING MONTH'S INVOICES.
PAYMENT FOR MATERIAL ON THIS ORDER WILL BE MADE ON THE 15TH OF MONTH FOLLOWING DELIVERY, AND 2% DEDUCTED UNLESS OTHERWISE AGREED.

THE W. W. BEACH COMPANY

REQUISITIONED BY ____________ ____________ PURCHASING AGENT

Fac-simile of Purchase Order Blank
(Original size 8½ by 11 inches)

be written beforehand in quadruplicate. If it is a cash item, one copy goes to job file and three to home office, each receipted by vendor (in place of an invoice). For items to be charged, the original of the four copies shall be given to vendor. Only such charge accounts should be opened as seem absolutely necessary, favoring such dealers as the owner prefers or as make best prices consistent with quality, and as give best service. All job purchase orders must be numbered consecutively, from No. 1 up, and each number accounted for to the home office, even though canceled, in which latter case, the reason for cancelation should be given. Wherever possible, purchase prices should be given on orders.

In all purchasing, note particularly that needs should be studied and lists made of all required materials which can be obtained from a single vendor, and competitive prices secured where possible; then the list should be ordered all at once,—enough, but not too much.

Single rush orders of small items mean added costs, additional bookkeeping and possible delays.

Telephone orders should be used only for emergency, and should be followed at once by job purchase orders confirming.

Cash should never be paid for any item to a vendor with whom there exists a charge account.

No general foreman or other employe should open a charge account away from home. They shall pay cash and their credit will not be recommended.

10. *Construction Forces.* One of the first duties of a general foreman upon arriving at a job will be to examine the local labor situation and report upon it in detail to the home office, advising what can be counted upon, what preferences are expressed by the owner, and any other suggestions of value. He will confer with the construction manager on the subject from time to time and will follow his instructions, employing always the best men available, at rates determined, getting best values at all times. In general, skilled labor should never be employed for work that can be done more economically by common labor. Workmen will be paid only for time actually employed, unless other special provision is approved by the home office. Over-time is only to be used when expressly pre-arranged for or in actual emergency. Foremen are to be employed only when the number of men in any trade warrants. The work done by themselves, as well as by the men under them, should be kept at maximum, just the same as if directly overseen by the general foreman. A week's work will consist of 44 to 60 hours' regular time, depending upon the season and the project's requirements, of which all employes are to be kept informed. Holidays will be observed, except in emergencies (approved by home office), and no pay allowed for them, unless pre-arranged. Pay for transportation or other unusual expenses must also be pre-arranged.

11. *Subcontracts.* When expedient, subcontracts will be let for specific work. The general foreman will be provided with copies of all such contracts and specifications governing them and will act as inspector of all work included therein; he will see that ample notice is given each subcontractor ahead of time such work is needed (particularly for members to be built into walls and concrete), that all provisions of such contracts are properly fulfilled, that the work is properly correlated with that of others,

This Report must give a complete accounting of *all* material on hand and received; its use, etc. Record must be carefully kept from day to day; balanced weekly and made out in triplicate each Tuesday. One copy each to Owner, Home Office and Job.

THE W. W. BEACH COMPANY

ARCHITECTS ENGINEERS BUILDERS

SIOUX CITY, IOWA

WEEKLY MATERIAL REPORT

FROM ______________ TO ______________

OWNER: ______________

LOCATION: ______________

JOB NO.: ______________

DATE: ______________

DATE		MATERIAL	QUANTITY REC'D	COST				PREVIOUSLY ON HAND	QUANTITY USED	HOW USED	BALANCE ON HAND
				RATE	AMOUNT	FREIGHT	HAULING				

SIGNED ______________ SUPERINTENDENT

Weekly Material Report (Size 8½ by 11 inches)

DAILY CONSTRUCTION REPORT

A report must be fully made out in duplicate, one kept on job and one mailed promptly to Home Office, six days a week and also on Sunday, if work is done that day. Each report must be an accurate record of conditions existing, job requirements, causes of delay etc.

THE ABCDEFG COMPANY
ENGINEERS ARCHITECTS BUILDERS
CHICAGO. ILLINOIS

OWNER
LOCATION
JOB NO.
DATE

WORK DAY NO. FORCE WORKED HOURS WEATHER CONDITIONS A.M. P.M. TEMP. TO

NUMBER AND KIND OF WORKMEN EMPLOYED

ABCDEFG CO'S. PAYROLL — OTHER PAYROLLS

TRADES	FOREMEN	MEN	TOTAL	TRADES	FOREMEN	MEN	TOTAL
OVERHEAD AND OFFICE MEN							
GRAND TOTAL				GRAND TOTAL			

Work to-day Consisted of

Cause of Delays, if any

Material Needed *Ordered (When)*

Expedited (How) *Expected (When)*

Drawings or Information Needed

First Requested

Daily Letter

(Use Other Side if Necessary) (SIGNED) GENERAL FOREMAN

Daily Construction Report Blank (Size 8½ by 11 inches)

and that amounts of partial payments demanded are proper and duly proportionate. Prior to the letting of such contracts, either by the home office direct or by the general foreman under order from the home office, it is essential to know (1) the general reputation of the party whose bid it is proposed to accept; (2) his equipment and other fitness for the work; (3) the attitude of his employes toward the architect's organization and its probable effect; and (4) the name of his liability insurance company and number of his policy, if the contract is to include labor at the job.

12. *Permits and Ordinances.* Before beginning a given project, the general foreman must familiarize himself with local and state ordinances and laws relating to the work and shall take out and pay for such permits as may be required, notifying the home office if any bonds are necessary. In general, subcontractors for plumbing, wiring and the like will secure their own permits, but the general foreman must see that those who do such work are properly licensed. Great care must be taken as to street and alley obstructions and occupancy of adjoining property.

13. *Insurance, Accidents, Etc.* The owner will carry fire insurance on work and equipment, and the company will maintain workmen's compensation insurance, but the general foreman will be expected to do all in his power to prevent fire and accidents, maintaining temporary fences and barricades, danger signs, "No Smoking" notices, red lights and other means of warning employes and the public. He must personally inspect all equipment, hoists, ladders, scaffolding, shoring and other possible sources of danger, known capacities, and see to and

make everything safe. He will be supplied with a "first aid kit" and must make himself and at least one other man familiar with its use, as well as seeing that it is kept properly filled. Telephone numbers of doctor, hospital, ambulance service, police and fire department must be prominently displayed in the office. All accidents must be reported promptly to the proper authorities and in detail to the home office, giving cause, result, treatment, present status, attending physician and means adopted to prevent the recurrence of accidents. Try to prevent the first accident as well as the next. Do not permit men to ride on material hoists.

14. *Temporary Buildings.* Such temporary structures as are directed by the construction manager, built as he instructs, are to be located to the best advantage and constructed as soon as possible after the arrival of the general foremen, who shall bear in mind their possible use in cold weather and also their value and disposition at completion of the work.

15. *Daily Construction Reports.* Daily construction reports are to be made out in duplicate, the original sent to the home office (mailed on day it records), and duplicates kept in proper sequence in job file. When so directed, a third carbon copy must be provided for the owner. Each detail of required information must be clearly given, and the progress of work from day to day given in percentages on in manner directed by the construction manager. No letter, other than that on the daily report, to the home office is necessary.

16. *Job Correspondence.* In general, all correspondence relating to a job will be handled by the home office, with copies to the general foreman of such letters as are needed in job file. The general foreman will hold to a minimum all correspondence with outsiders, thus avoiding duplicating the work of others. Emergency matters having to do with expediting, corrections, etc., should be handled promptly by mail, telephone or telegraph, with copy to the home office in each case. All correspondence regarding shop drawings, also their checking, will be handled by the home office, but copies will be sent the general foreman for approval or record. These and all other correspondence records shall be carefully filed. All mail for the work will be directed to the company, for which purpose the general foreman shall promptly provide a street address or will rent a post office box, if preferable.

17. *Telephone and Telegraph Service.* On day of arrival at a job, the general foreman will call at the local telegraph and telephone offices and make arrangements for prompt service, both day and night. If a job phone is to be installed, the contract should be made at once in the name of the company, so that it can be put in as soon as the office is ready. Unless confirmation is made by job purchase order, all telephone calls of importance must be recorded in duplicate on "Telephone Record" blanks, one copy to home office and one to job file. A third copy must be made of messages of sufficient importance and sent to other party to the conversation for confirmation. Such confirmation may be a deciding factor in some important matter.

18. *Changes* from the work as laid out by drawings and specifications are always a fruitful source of error and expense and are to be avoided as much as possible. The general foreman must never suggest a change to the owner nor allow another employe to do so. Advice and constructive criticism are always welcomed, but the home office will take care of all business dealings with the owner. The general foreman is sent out to construct the building in accordance with drawings and specifica-

WEEKLY PAYROLL REPORT

THIS PAYROLL MUST BE MADE OUT IN TRIPLICATE EACH WEEK AND DUPLICATES SENT TO HOME OFFICE NOT LATTER THAN THE FOLLOWING TUESDAY	THE ABCDEFG COMPANY ENGINEERS ARCHITECTS BUILDERS CHICAGO, ILLINOIS	OWNER LOCATION JOB NO.
	FROM TO	DATE

NO.	NAME AND TRADE	WORKED AT	DATE / DATE	S	S	M	T	W	T	F	HOURS	TOTAL HOURS	RATE	AMOUNT
		TOTAL												
		(SIGNED)									GENERAL FOREMAN			

Weekly Payroll Report Blank (Size 8½ by 11 inches)

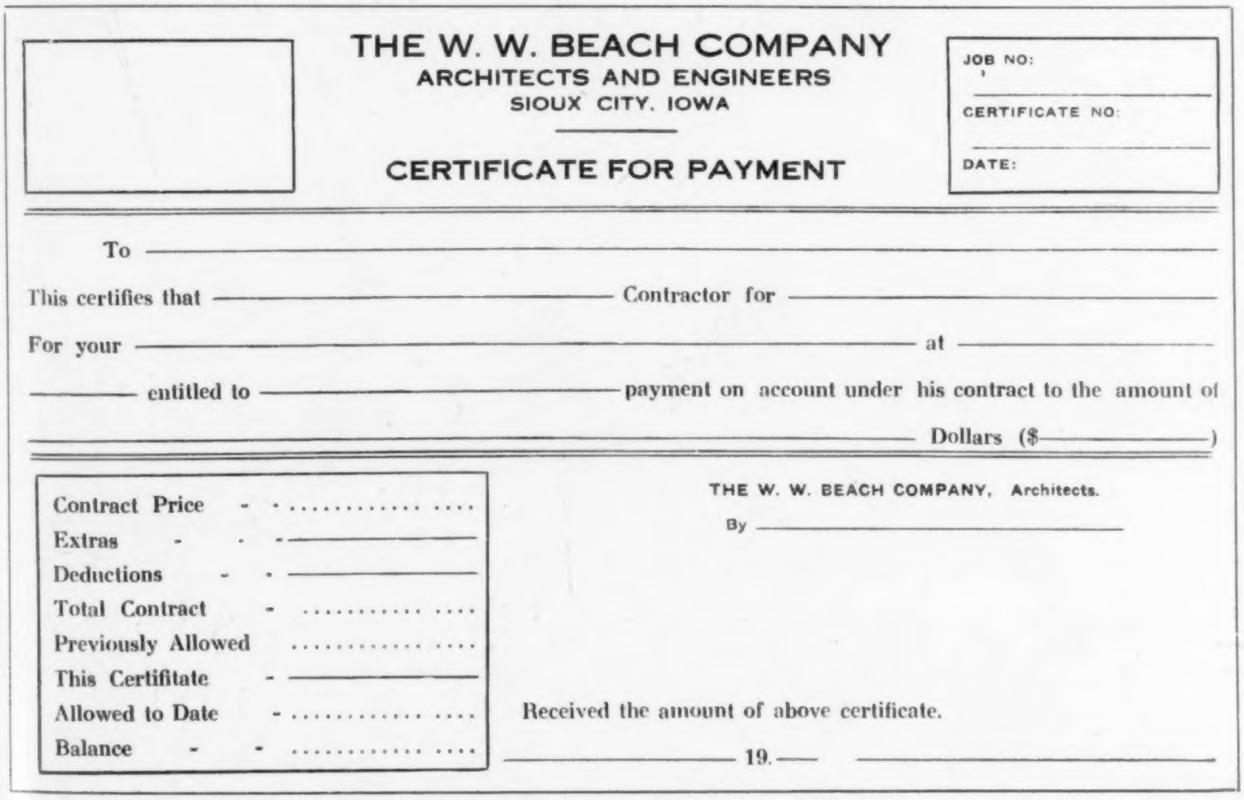
tions and has no authority to make any change whatever without first consulting the construction manager or home office. The home office must receive immediate notification in event of any dispute with or expression of dissatisfaction on the part of the owner, and that portion of the work affected shall not proceed until a decision (permanent or temporary) has been made.

In the same way these important subjects are taken up in order and specific instructions given:

19. Extra Work Orders
20. Payrolls
21. Funds for Payrolls and Incidentals
22. Hauling
23. Returnable Items
24. Transferred Items
25. Weekly Cash Reports
26. Tool Reports
27. Equipment Reports
28. Weekly Material Reports
29. Cost Accounting
30. Cost Schedule.

In General. The loyalty of the home office to the interests of the owner is its first consideration, but the success of its building methods depends largely upon the loyalty of employes to the home office. The first sign of dissatisfaction on the part of the owner is generally found to be due to gossip of disappointed local competitors or of their employes or some one who has been discharged. This should be watched and defeated if possible, the home office being always kept informed. The owner must be shown a whole-hearted attention to his interests that is thoroughly convincing. The general foreman should also keep the home office fully informed as to all other matters relating to the work in hand and regarding any other items of building activity or prospects in the vicinity in which the home office might be interested. While the particular work in hand is supposed to demand all of the general foreman's time (including overtime when necessary) regardless of regular hours, it is assumed also that he will be alive to what is going on around him,—that he possesses something better than a "one-track mind." He will be expected to so conduct himself and his affairs as to obtain these results when the work is completed: A. A first quality structure, as set forth in drawings and specifications. B. Completion according to time schedule or better. C. Closure or complete adjustment of all unsettled matters and accounts preparatory to the final billing. D. A written acceptance by the owner, to be obtained by the construction manager, indicating entire satisfaction.

The foregoing instructions, although apparently somewhat lengthy, will by no means be found adequate for all work. Much still devolves upon the construction manager in the way of advice, and still more upon the experience and initiative of the general foreman himself. In this article, we are dealing only with the duties of purchasing and supervising. Auditing and accounting require the services of an expert bookkeeper. Hence, with proper care in building up his field organization, it should be apparent that the high class architect is at least as well qualified to engage in actual building as is the general contractor to undertake to do his client's planning.


THE W. W. BEACH COMPANY
ARCHITECTS AND ENGINEERS
SIOUX CITY, IOWA

CERTIFICATE FOR PAYMENT

JOB NO:
CERTIFICATE NO:
DATE:

To

This certifies that Contractor for

For your at

entitled to payment on account under his contract to the amount of

Dollars ($)

Contract Price	
Extras	
Deductions	
Total Contract	
Previously Allowed	
This Certifitate	
Allowed to Date	
Balance	

THE W. W. BEACH COMPANY, Architects.

By

Received the amount of above certificate.

19.

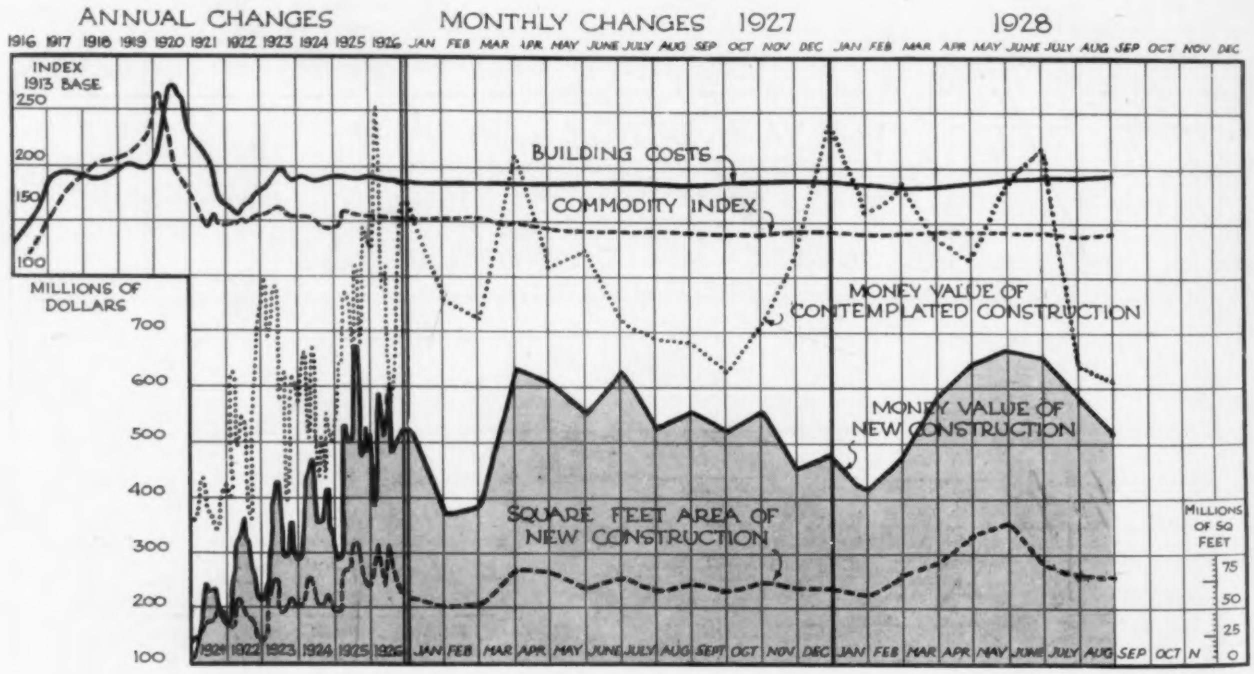
Certificate for Payment used by the Author

THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

THE usual summer slump in both the volume of new construction and the amount of contemplated work took place during July and August, although not in sufficient measure to prevent the first seven months of the year from establishing a new record for the total amount of construction. According to the figures of the F. W. Dodge Corporation, the building and engineering contracts awarded during July in the 37 states east of the Rockies amounted to $583,432,400. This represents about 91 per cent of the entire country, and the figure was the highest July contract total on record. It was 9 per cent ahead of the July, 1927 total, but was a drop of 10 per cent from the total for June of this year. Two districts made new high totals for the month of July, —the Middle Atlantic States and the Central Western States (which enjoyed the highest monthly totals ever made in these territories, while the New England and the Southeastern States exceeded the volume of construction over July, 1927. In New York state and northern New Jersey, in the Pittsburgh district, the Northwest, and in Texas there was a decline as compared with July, 1927 figures; and only in the Central Western, the Northwestern and in the Southeastern States, did July totals exceed the figures recorded for the preceding month of this year.

The distribution of building construction by types showed $228,734,800 or 39 per cent of the total for residential construction; $137,074,700 or 23 per cent for public works and utilities; $95,696,800 or 16 per cent for commercial buildings; $36,926,400 or 6 per cent for educational projects; and $31,399,800 or 5 per cent for industrial projects. A decided drop in new work contemplated took place during July, the total for the month being $647,682,700, which is a loss of 37 per cent from the amount reported in June, 1928, and a drop of 7 per cent below the amount reported for July of last year. In August construction contracts to the amount of $516,970,200 were awarded in the Eastern States, which is about 11 per cent below the July figure and 6 per cent below the figure for August, 1927. The New England States and the Northwest were the only two districts showing increases over their July, 1928 records, and the Central West, Northwest, and Southeastern States were the districts which showed increases over their records for August of last year. The total amount of new building and engineering work started since the first of the year amounts to $4,545,-270,100, an increase of 6 per cent over that of 1927.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Value of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp., and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.